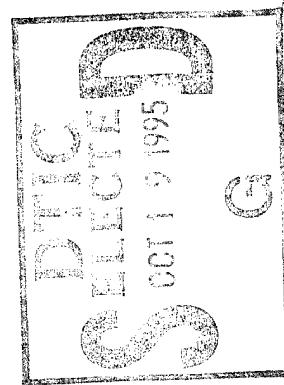




RESEARCH SUPPORT ON FOREIGN FUNDING OF
FOSSIL FUEL AND ALTERNATIVE ENERGY R&D



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November 1994

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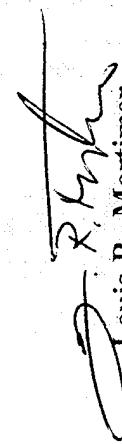
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TABLE OF CONTENTS

PREFACE	1
COMPARISON OF COUNTRIES	2
TABLE 1. GOVERNMENT BUDGET APPROPRIATIONS OR OUTLAYS FOR ENERGY R&D, 1989-93	3
TABLE 2. GOVERNMENT ENERGY R&D BUDGETS, 1989-93	5
TABLE 3. GOVERNMENT ENERGY R&D BUDGETS IN 1992 NATIONAL CURRENCIES, 1989-93	6
TABLE 4. GOVERNMENT ENERGY R&D BUDGETS IN 1992 U.S. DOLLARS, 1989-93	7
TABLE 5. GOVERNMENT ENERGY R&D EXPENDITURES, PER UNIT OF GDP, 1989-93	8
TABLE 6. DISTRIBUTION OF PUBLIC FUNDS FOR ENERGY RESEARCH, 1989-93	9
TABLE 7. GOVERNMENT R&D BUDGETS FOR ENERGY, BY SUBCOMPONENT, 1989	10
TABLE 8. GOVERNMENT R&D BUDGETS FOR ENERGY, BY SUBCOMPONENT, 1989	12
TABLE 9. GOVERNMENT R&D BUDGETS FOR ENERGY, BY SUBCOMPONENT, 1989	14
TABLE 10. GOVERNMENT R&D BUDGETS FOR ENERGY, BY SUBCOMPONENT, 1990	16
TABLE 11. GOVERNMENT R&D BUDGETS FOR ENERGY, BY SUBCOMPONENT, 1990	18
TABLE 12. GOVERNMENT R&D BUDGETS FOR ENERGY, BY SUBCOMPONENT, 1990	20
TABLE 13. ACTUAL IEA GOVERNMENT ENERGY R&D EXPENDITURES BY COUNTRY, BY SUBCOMPONENT, 1992	22
TABLE 14. ACTUAL IEA GOVERNMENT ENERGY R&D EXPENDITURES BY COUNTRY, BY SUBCOMPONENT, 1992	24
TABLE 15. ACTUAL IEA GOVERNMENT ENERGY R&D BUDGETS BY COUNTRY, BY SUBCOMPONENT, 1992	26
TABLE 16. IEA GOVERNMENT ENERGY R&D EXPENDITURES BY COUNTRY, BY SUBCOMPONENT, 1993	28
TABLE 17. IEA GOVERNMENT ENERGY R&D EXPENDITURES BY COUNTRY, BY SUBCOMPONENT, 1993	30
TABLE 18. IEA GOVERNMENT ENERGY R&D EXPENDITURES BY COUNTRY, BY SUBCOMPONENT, 1993	32
TABLE 19. GOVERNMENT R&D BUDGETS FOR OIL AND GAS, 1989-93	34

TABLE 20. GOVERNMENT R&D BUDGETS FOR COAL, 1989-93	35
TABLE 21. GOVERNMENT-FINANCED RESEARCH ON RENEWABLE ENERGY SOURCES, 1989-93	36
TABLE 22. GOVERNMENT R&D BUDGETS FOR RENEWABLE SOURCES OF ENERGY, 1989-93	38
TABLE 23. GOVERNMENT R&D BUDGETS FOR ELECTRICITY, 1989-93	39
TABLE 24. GOVERNMENT R&D BUDGETS FOR ENERGY SYSTEMS ANALYSIS AND OTHER PROGRAMS, 1989-93	40
TABLE 25. GOVERNMENT-FINANCED RESEARCH ON FOSSIL FUELS AND THEIR DERIVATIVES, 1989-94	41
TABLE 26. GOVERNMENT-FINANCED GENERAL ENERGY RESEARCH, 1989-93	43
TABLE 27. GOVERNMENT-FINANCED MISCELLANEOUS RESEARCH ON PRODUCTION, DISTRIBUTION, AND RATIONAL UTILIZATION OF ENERGY, 1989-93	45
INDIVIDUAL COUNTRIES	47
AUSTRALIA	48
TABLE 28. AUSTRALIA: ENERGY R&D BY SECTOR AND SOURCE OF FUNDS, 1988-89	49
TABLE 29. AUSTRALIA: ENERGY R&D EXPENDITURES BY BUSINESS ENTERPRISES, BY INDUSTRY, 1988-89 AND 1990-91	52
TABLE 30. AUSTRALIA: R&D EXPENDITURES BY GENERAL GOVERNMENT ORGANIZATIONS, 1990-91	54
TABLE 31. AUSTRALIA: HUMAN RESOURCES DEVOTED TO R&D BY GENERAL GOVERNMENT ORGANIZATIONS, 1990-91	55
TABLE 32. AUSTRALIA: R&D EXPENDITURES BY NON-PROFIT ORGANIZATIONS, 1990-91	56
TABLE 33. AUSTRALIA: HUMAN RESOURCES DEVOTED TO R&D BY PRIVATE NON-PROFIT ORGANIZATIONS, 1990-91	57
TABLE 34. AUSTRALIA: MAJOR R&D GRANT PROGRAMS AND OTHER SUPPORT FOR SCIENCE AND INNOVATION THROUGH THE BUDGET, 1990-91	58
FRANCE	60
TABLE 35. FRANCE: DOMESTIC EXPENDITURES FOR ENERGY R&D, 1989-91	60
GERMANY	61
TABLE 36. GERMANY: FEDERAL EXPENDITURES FOR ENERGY R&D, 1989-93	62

TABLE 37. GERMANY: RENEWABLE ENERGY IN THE "3RD PROGRAM FOR ENERGY RESEARCH AND ENERGY TECHNOLOGIES" OF THE GERMAN FEDERAL GOVERNMENT, 1989-92	63
INDONESIA	64
TABLE 38. INDONESIA: INVESTMENTS IN GEOTHERMAL PROJECTS IN REPELITA V	65
TABLE 39. INDONESIA: INVESTMENTS IN NEW AND RENEWABLE ENERGY SOURCE DEVELOPMENT PROJECTS IN REPELITA V	66
TABLE 40. INDONESIA: INVESTMENTS IN BIOMASS ENERGY DEVELOPMENT PROJECTS IN REPELITA V	67
ITALY	68
TABLE 41. ITALY: ENI R&D EXPENDITURES, 1989-93	69
JAPAN	72
TABLE 42. JAPAN: BUDGETS FOR ENERGY R&D, BY SUBCOMPONENT, 1989-92	73
TABLE 43. JAPAN: EXPENDITURES FOR ENERGY R&D BY INDUSTRY, 1989-92	75
TABLE 44. JAPAN: EXPENDITURES FOR ENERGY R&D BY GOVERNMENT RESEARCH INSTITUTES, 1989-92	77
TABLE 45. JAPAN: EXPENDITURES FOR ENERGY R&D BY UNIVERSITIES AND COLLEGES, 1989-92	79
TABLE 46. JAPAN: EXPENDITURES FOR ENERGY R&D BY PRIVATE RESEARCH INSTITUTES, 1989-92	81
TABLE 47. JAPAN: GOVERNMENT BUDGET FOR ENERGY R&D, 1989-93	83
TABLE 48. JAPAN: BUDGET FOR "NEW SUNSHINE" PROJECT, FY1992 AND FY1993	84
NETHERLANDS	86
TABLE 49. NETHERLANDS: GOVERNMENT FINANCING OF ENERGY R&D, 1991-97	87
TABLE 50. NETHERLANDS: GOVERNMENT EXPENDITURE FOR ENERGY R&D, BY TYPE OF INSTITUTE, 1991	88
NORWAY	89
TABLE 51. NORWAY: BUDGETS FOR ENERGY R&D, 1989-94	90
SPAIN	91
TABLE 52. SPAIN: ENERGY RESEARCH PLAN: 1989-1992	92

TABLE 53. SPAIN: ENERGY RESEARCH PLAN, BY SECTOR AND SUBCOMPONENT, 1989-1992	93
SWEDEN	95
TABLE 54. SWEDEN: ESTIMATED ENERGY AND WATER SUPPLY R&D FUNDS, BY MINISTRIES, 1993/94	96
TABLE 55. SWEDEN: ESTIMATED ENERGY AND WATER SUPPLY R&D FUNDS, 1989/90 TO 1993/94	97
TABLE 56. SWEDEN: ESTIMATED ENERGY AND WATER SUPPLY R&D FUNDS, 1989/90 PRICES, 1989/90 TO 1993/94	98
TABLE 57. SWEDEN: ESTIMATED ENERGY AND WATER SUPPLY R&D FUNDS, 1989/90 TO 1993/94	99
TABLE 58. SWEDEN: CHANGES IN GOVERNMENT ENERGY AND WATER SUPPLY R&D FUNDS, 1989/90 TO 1993/94	100
SWITZERLAND	101
TABLE 59. SWITZERLAND: EXPENDITURES OF PUBLIC ORGANIZATIONS (INCLUDING THE NATIONAL ENERGY RESEARCH FOUNDATION) ON ENERGY RESEARCH, 1990-93	102
TABLE 60. SWITZERLAND: SWISS ENERGY R&D CLASSIFICATION SYSTEM	104
TABLE 61. SWITZERLAND: ENERGY R&D EXPENDITURES ACCORDING TO THE SWISS CLASSIFICATION SYSTEM, 1990-1993	105
FIGURE 1. SWITZERLAND: EXPENDITURES FOR ENERGY R&D, 1977-93	106
FIGURE 2. SWITZERLAND: EXPENDITURES FOR ENERGY R&D, CORRECTED FOR INFLATION (1993 = 100%), 1977-93	107
FIGURE 3. SWITZERLAND: PROPORTIONAL DISTRIBUTION OF ENERGY R&D EXPENDITURES, 1977-93	108
TABLE 62. SWITZERLAND: DISTRIBUTION OF ENERGY R&D FUNDING BY PUBLIC ORGANIZATIONS, BY SOURCE OF FINANCING, 1991	109
TABLE 63. SWITZERLAND: DISTRIBUTION OF ENERGY R&D FUNDING BY PUBLIC ORGANIZATIONS, BY SOURCE OF FINANCING, 1992	110
TABLE 64. SWITZERLAND: DISTRIBUTION OF ENERGY R&D FUNDING BY PUBLIC ORGANIZATIONS, BY SOURCE OF FINANCING, 1993	111

TABLE 65. SWITZERLAND: DISTRIBUTION OF FUNDS AMONG ENERGY RESEARCH INSTITUTIONS, 1992	112
TABLE 66. SWITZERLAND: DISTRIBUTION OF FUNDS AMONG ENERGY RESEARCH INSTITUTIONS, 1993	113
TABLE 67. SWITZERLAND: DISTRIBUTION OF PUBLIC FUNDS AMONG ENERGY RESEARCH INSTITUTIONS, BY AREA OF RESEARCH, 1991	114
TABLE 68. SWITZERLAND: DISTRIBUTION OF PUBLIC FUNDS AMONG ENERGY RESEARCH INSTITUTIONS, BY AREA OF RESEARCH, 1992	115
TABLE 69. SWITZERLAND: DISTRIBUTION OF PUBLIC FUNDS AMONG ENERGY RESEARCH INSTITUTIONS, BY AREA OF RESEARCH, 1993	116
TABLE 70. SWITZERLAND: TOTAL EXPENDITURES FOR ENERGY RESEARCH, BY SECTOR, 1993	117
TABLE 71. SWITZERLAND: FEDERAL PROGRAMS FOR ENERGY RESEARCH AND EXPENDITURES, 1992 AND 1993	118
TABLE 72. SWITZERLAND: PARTIAL LIST OF ENERGY RESEARCH PROJECTS, 1993 TAIWAN	120
TABLE 73. TAIWAN: ENERGY R&D BUDGET, FY1989-93 UNITED KINGDOM	123
TABLE 74. UNITED KINGDOM: DEPARTMENT OF TRADE AND INDUSTRY ENERGY R&D BUDGET, FY1990-94	124
TABLE 75. UNITED KINGDOM: DEPARTMENT OF TRADE AND INDUSTRY EXPENDITURES ON RENEWABLE ENERGY FY1989-92	125
BIBLIOGRAPHY	126
	127
	128
	129

PREFACE

This study is a compendium of open-source materials, for the period 1989-94, on fossil fuel and alternative energy R&D funding in selected industrialized countries. The information is presented in two types of tables: tables showing the expenditures of all the countries and tables showing the expenditures of a single country over a given period of time.

Because most materials available from library sources did not provide up-to-date information, the sources used in preparing this study were mainly statistical publications of the Organization of Economic Co-operation and Development (OECD) and materials provided by ministries, statistical bureaus, and public organizations of various countries. The Washington embassies of the countries under study and United States embassies located in these countries provided valuable materials without which this study would not have been possible.

Unless otherwise noted, the figures in the tables are in the currency of the given year, i.e. they are not corrected for inflation. The abbreviation *n.a.* means not available.

COMPARISON OF COUNTRIES

TABLE 1. GOVERNMENT BUDGET APPROPRIATIONS OR OUTLAYS FOR ENERGY R&D, 1989-93
(In millions of the national currency and percentage of total R&D)

Country	1989 Funds*	% ^l	1990 Funds*	% ^l	1991 Funds*	% ^k	Funds	1992 % ^l ^o	Funds	1993* % ^l
Australia	45.9	n.a.	55.7	n.a.	55.0	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	207.0	3.4	204.5	3.4	200.0 ^h	3.2	233.1 ^{sp}	4.0	n.a.	n.a.
France	2,918.0	3.4	2,657.9 ^o	3.0	2,944.0 ^h	3.2	2,923.5 ^{tp}	3.0	n.a.	n.a.
Germany	1,520.4	6.4	1,503.9	6.0	1,520.9 ^h	5.2 ^b	1,459.8 ^{bf}	4.7 ^b	n.a.	n.a.
Indonesia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Italy	537,720 ^f	6.1	567,620 ^o	5.9	546,172.0	5.1	430,960.0 ^{tp}	3.7	n.a.	n.a.
Japan	354,289 ^o	n.a.	367,845 ^o	n.a.	366,957 ^o	n.a.	356,194 ^o	n.a.	364,930 ^o	n.a.
Netherlands	157.3 ^f	3.6	161.6 ^o	3.4	159.7 ^h	3.4	142.7 ^{tp}	3.0	154.9 ^{op}	n.a.
Norway	215.0	n.a.	293.0	n.a.	298.0 ^p	n.a.	328.4 ^{op}	n.a.	n.a.	n.a.
Spain	7,144 ^f	3.1	7,160 ^o	2.6	7,046 ^h	2.4	6,068 ^{tp}	2.0	n.a.	n.a.
Sweden	538.0	n.a.	564.0	n.a.	510.0	n.a.	441.0 ^o	n.a.	n.a.	n.a.
Switzerland	39.0 ^c	n.a.	39.0 ^c	n.a.	42.0 ^c	n.a.	n.a.	n.a.	n.a.	n.a.
Taiwan ^e	2,426	7.3	2,082	5.5	3,154	8.3	n.a.	n.a.	n.a.	n.a.
United Kingdom ^l	158.9 ^f	3.3	153.1 ^m	n.a.	126.3 ^m	n.a.	113.2 ⁿ	n.a.	93.8 ^{mp}	n.a.

See next page for footnotes.

Table 1. Continued

^aBased on information from Organization for Economic Co-operation and Development, Basic Science and Technology Statistics (Statistiques de base de la science et de la technologie), Paris, 1993, unless otherwise noted.

^bIncludes the new *Länder*.

^cNational estimate or projection adjusted, if necessary, by the Secretariat to meet OECD norms.

^dBased on information from International Energy Agency, Energy Policies and Programmes of IEA Countries: 1989 Review, Paris, 1990, 86.

^eAll figures for Taiwan based on information from Republic of China, Council for Economic Planning and Development, Taiwan Statistical Data Book 1994, n.p., 1994, 107.

^fBased on information from Office des publications officielles des Communautés européennes, Öffentliche aufwendungen für forschung und entwicklung 1980-1990/Government Financing of Research and Development 1980-1990/Le financement public de la recherche et du développement 1980-1990, Luxembourg, 1991, 62-63.

^gBased on information from Office des publications officielles des Communautés européennes, Öffentliche aufwendungen für forschung und entwicklung 1980-1991/Government Financing of Research and Development 1980-1991/Le financement public de la recherche et du développement 1980-1991, Luxembourg, 1992, 148-49.

^hBased on information from Office des publications officielles des Communautés européennes, Forschung und entwicklung: jährliche statistiken 1993/Research and Development: Annual Statistics 1993/Recherche et développement: statistiques annuelles 1993, Luxembourg, 1993, 128-29.

ⁱBased on information from Office des publications officielles des Communautés européennes, Öffentliche aufwendungen für forschung und entwicklung 1980-1990/Government Financing of Research and Development 1980-1990/Le financement public de la recherche et du développement 1980-1990, Luxembourg, 1991, 66-67.

^jBased on information from Office des publications officielles des Communautés européennes, Öffentliche aufwendungen für forschung und entwicklung 1980-1991/Government Financing of Research and Development 1980-1991/Le financement public de la recherche et du développement 1980-1991, Luxembourg, 1992, 152-53.

^kBased on information from Office des publications officielles des Communautés européennes, Forschung und entwicklung: jährliche statistiken 1993/Research and Development: Annual Statistics 1993/Recherche et développement: statistiques annuelles 1993, Luxembourg, 1993, 132-33.

^lThe U.K. fiscal year begins 1 April.

^mBased on information from the United Kingdom, Office of Public Service and Science, Office of Science and Technology, Annual Review of Government Funded Research and Development 1993, London, 1993, 259.

ⁿEstimate.

^oBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1994, 140.

^pProvisional. Actual figure to be published at a later date.

TABLE 2. GOVERNMENT ENERGY R&D BUDGETS, 1989-93
 (In millions of the national currency)

Country	1989	1990	1991	1992	1993
Australia	91.7	n.a.	n.a.	n.a.	n.a.
Denmark	154.5	215.0	262.0	n.a.	n.a.
France	n.a.	3,184.0	3,183.0	n.a.	n.a.
Germany	799.1	856.0	863.0	786.8	n.a.
Indonesia	n.a.	n.a.	n.a.	n.a.	n.a.
Italy	844,800	798,500	788,700	n.a.	n.a.
Japan	375,600	367,700	383,000	n.a.	n.a.
Netherlands	279.9	304.1	304.1	n.a.	n.a.
Norway	313.7	323.7	368.5	393.5	n.a.
Spain	7,095.0	5,409.1	12,823.8	15,622.1	n.a.
Sweden	556.6	561.5	567.0	754.0	n.a.
Switzerland	165.4	177.0	190.0	n.a.	n.a.
Taiwan	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	190.2	166.7	142.9	133.7	n.a.

Source: Based on information from International Energy Agency, *Energy Policies of IEA Countries: 1992 Review*, Paris, 1993, 516.

TABLE 3. GOVERNMENT ENERGY R&D BUDGETS IN 1992 NATIONAL CURRENCIES, 1989-93
 (In millions of the 1992 national currency)

Country	1989	1990	1991	1992	1993
Australia	98.3	n.a.	n.a.	n.a.	n.a.
Denmark	164.4	223.6	267.1	n.a.	n.a.
France	n.a.	3,354.3	3,268.3	n.a.	n.a.
Germany	900.1	932.5	902.3	786.8	n.a.
Indonesia	n.a.	n.a.	n.a.	n.a.	n.a.
Italy	1,017.500	894,800	825,100	n.a.	n.a.
Japan	398,200	382,600	389,900	n.a.	n.a.
Netherlands	303.2	320.1	310.5	n.a.	n.a.
Norway	330.8	326.7	365.0	393.5	n.a.
Spain	8,646.1	6,143.2	13,636.8	15,622.1	n.a.
Sweden	666.9	616.0	574.9	754.0	n.a.
Switzerland	189.2	192.3	194.4	n.a.	n.a.
Taiwan	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	227.0	186.4	149.5	133.7	n.a.

Source: Based on information from International Energy Agency, Energy Policies of IEA Countries: 1992 Review, Paris, 1993, 517.

TABLE 4. GOVERNMENT ENERGY R&D BUDGETS IN 1992 U.S. DOLLARS, 1989-93
 (In millions of 1992 U.S. dollars)

Country	1989	1990	1991	1992	1993	Average 1992 Exchange Rate Unit per Dollar
Australia	72.3	n.a.	n.a.	n.a.	n.a.	1.3600
Denmark	27.3	37.1	44.4	n.a.	n.a.	6.0209
France	n.a.	635.0	618.8	n.a.	n.a.	5.2821
Germany	577.4	598.2	578.7	504.7	n.a.	1.5590
Indonesia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Italy	830,900	730,700	673,800	n.a.	n.a.	1,224.5770
Japan	2,955.9	2,839.9	2,894.4	n.a.	n.a.	134.7100
Netherlands	172.7	182.3	176.9	n.a.	n.a.	1.7556
Norway	53.5	52.8	59.0	63.7	n.a.	6.1822
Spain	84.7	60.2	133.5	153.0	n.a.	102.1217
Sweden	116.7	107.8	100.6	131.9	n.a.	5.7145
Switzerland	135.1	137.3	138.7	n.a.	n.a.	1.4009
Taiwan	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	399.1	327.6	262.9	235.1	n.a.	0.5688

Source: Based on information from International Energy Agency, Energy Policies of IEA Countries: 1992 Review, Paris, 1993, 518.

TABLE 5. GOVERNMENT ENERGY R&D EXPENDITURES, PER UNIT OF GDP, 1989-93
 (Excluding nuclear research)

Country	1989	1990	1991	1992	1993
Australia	0.19	n.a.	n.a.	n.a.	n.a.
Denmark	0.18	0.22	0.29	n.a.	n.a.
France	n.a.	0.10	0.09	n.a.	n.a.
Germany	n.a.	n.a.	0.12	0.13	n.a.
Indonesia	n.a.	n.a.	n.a.	n.a.	n.a.
Italy	0.48	0.41	0.41	n.a.	n.a.
Japan	0.17	0.16	0.17	n.a.	n.a.
Netherlands	0.47	0.48	0.45	n.a.	n.a.
Norway	0.45	0.46	0.46	0.49	n.a.
Spain	0.08	0.06	0.17	0.19	n.a.
Sweden	0.40	0.37	0.32	0.45	n.a.
Switzerland	0.34	0.35	0.37	n.a.	n.a.
Taiwan	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	0.10	0.10	0.07	0.07	n.a.

Source: Based on information from International Energy Agency, *Energy Policies of IEA Countries: 1992 Review*, Paris, 1993, 519.

TABLE 6. DISTRIBUTION OF PUBLIC FUNDS FOR ENERGY RESEARCH, 1989-93
(In millions of 1993 U.S. dollars)

Country	1989	1990	1991	1992	1993
Australia	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	n.a.	n.a.	n.a.	n.a.	n.a.
France	n.a.	604.1	588.6	540.5	553.3
Germany	550.5	570.3	551.8	446.9	420.4
Indonesia	n.a.	n.a.	n.a.	n.a.	n.a.
Italy	657.9	578.5	533.5	n.a.	n.a.
Japan	3,620.3	3,478.1	3,544.9	n.a.	5,035.0
Netherlands	165.0	174.2	169.0	163.0	150.8
Norway	47.2	46.6	52.1	56.0	51.7
Spain	n.a.	n.a.	n.a.	n.a.	n.a.
Sweden	87.0	80.4	75.0	97.0	73.5
Switzerland	130.3	132.4	133.8	144.6	148.9
Taiwan	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	344.7	283.0	227.1	202.7	178.1

Source: Based on information from Switzerland, L'Office fédéral de l'énergie, Recherche, développement et démonstration dans le domaine de l'énergie en Suisse: Liste des projets, 1992/1993, Berne, April 1994, 20.

TABLE 7. GOVERNMENT R&D BUDGETS FOR ENERGY, BY SUBCOMPONENT, 1989
(In millions of 1990 U.S. dollars and percentage)

Group Technology Area	Australia \$	Australia %	Denmark \$ %	France \$ %	Germany \$ %	Indonesia \$ %
OIL & GAS						
Enhanced oil & gas	n.a.	n.a.	0	0	n.a.	11.99
Refining transp. (O&G)	n.a.	n.a.	0	0	n.a.	0
Oil share [sic] & tar sands	n.a.	n.a.	0	0	n.a.	0
Other	n.a.	n.a.	0	0	n.a.	0
TOTAL OIL & GAS	n.a.	2.46	7.15	n.a.	11.99	2.73
COAL						
Coal prod. prep. & transport	n.a.	n.a.	0	0	n.a.	15.67
Coal combustion	n.a.	n.a.	0	0	n.a.	33.88
Coal conversion	n.a.	n.a.	0	0	n.a.	16.61
Other	n.a.	n.a.	0	0	n.a.	2.80
TOTAL COAL	n.a.	6.51	18.93	n.a.	68.97	15.69
SOLAR						
Solar heating & cooling	n.a.	n.a.	0	0	n.a.	13.20
Solar photo electric	n.a.	n.a.	0	0	n.a.	45.37
Solar thermal electric	n.a.	n.a.	0	0	n.a.	4.12
TOTAL SOLAR	n.a.	0.58	1.68	n.a.	62.70	14.27

Group Technology Area	Australia \$ %	Denmark \$ %	France \$ %	Germany \$ %	Indonesia \$ %
OTHER NEW SOURCES					
Wind	n.a.	6.97	20.25	6.98	1.59
Ocean	n.a.	0.42	1.23	0	0
Biomass	n.a.	1.71	4.97	0	0
Geothermal	n.a.	0	0	1.48	0.34
TOTAL SOLAR & OTHER NEW SOURCES	n.a.	9.68	28.13	n.a.	71.17
MISCELLANEOUS--I					
Electric power conversion	n.a.	0	0	n.a.	0
Electricity transmission	n.a.	0	0	n.a.	1.48
Energy storage	n.a.	2.53	7.35	n.a.	5.61
TOTAL MISCELLANEOUS--I	n.a.	2.53	7.35	n.a.	7.09
MISCELLANEOUS--II					
Energy systems analysis	n.a.	1.43	4.15	n.a.	1.21
Others	n.a.	0	0	n.a.	0
TOTAL MISCELLANEOUS--II	n.a.	1.43	4.15	n.a.	1.21
TOTAL ENERGY R&D BUDGET	n.a.	34.41	100.00	n.a.	439.50

^aFigures as given in the original.

Source: Based on information from International Energy Agency, Energy Policies of IEA Countries, Paris, 1991, 154-57.

TABLE 8. GOVERNMENT R&D BUDGETS FOR ENERGY, BY SUBCOMPONENT, 1989
 (In millions of 1990 U.S. dollars and percentage)

Group Technology Area	Italy \$	Italy %	Japan \$	Japan %	Netherlands \$	Netherlands %	Norway \$	Norway %	Spain \$	Spain %
OIL & GAS										
Enhanced oil & gas	0	0	3.09	0.11	0	0	3.53	7.43	0	0
Refining transp. (O&G)	0	0	54.80	1.98	0.58	0.43	3.14	6.60	0	0
Oil share [sic] & tar sands	0	0	1.10	0.04	0	0	0	0	0	0
Other	0	0	3.11	0.11	0	0	13.59	28.56	0	0
TOTAL OIL & GAS	0	0	62.10	2.25	0.58	0.43	20.26	42.59	0	0
COAL										
Coal prod. prep. & transport	0.16	0.02	11.93	0.43	0.15	0.11	0	0	1.63	2.54
Coal combustion	0.16	0.02	32.05	1.16	0.68	0.50	0.11	0.22	0.14	0.21
Coal conversion	0.12	0.02	181.38	6.56	0.44	0.32	0	0	0	0
Other	0	0	4.78	0.17	24.04	17.65	0	0	0.13	0.20
TOTAL COAL	0.43	0.07	230.15	8.33	25.30	18.58	0.11	0.22	1.90	2.95
SOLAR										
Solar heating & cooling	0.31	0.05	2.86	0.10	0.73	0.54	0.76	1.59	1.62	2.51
Solar photo electric	14.59	2.22	48.38	1.75	2.53	1.86	0	0	2.01	3.11
Solar thermal electric	0	0	0	0	2.43	1.79	0	0	0.32	0.49
TOTAL SOLAR	14.90	2.26	51.24	1.85	5.69	4.18	0.76	1.59	3.94	6.12

Group Technology Area	\$	Italy %	\$	Japan %	\$	Netherlands %	\$	Norway %	\$	Spain %
OTHER NEW SOURCES										
Wind	17.96	2.73	1.75	0.06	6.47	4.75	0.83	1.75	1.05	1.63
Ocean	0	0	0.73	0.03	0.97	0.71	0.23	0.48	0	0
Biomass	6.17	0.94	7.87	0.28	4.23	3.11	1.15	2.42	6.83	10.60
Geothermal	0	0	39.60	1.43	1.95	1.43	0	0	1.54	2.40
TOTAL SOLAR & OTHER NEW SOURCES	39.04	5.93	101.19	3.66	19.32	14.18	2.97	6.25	13.37	20.75
MISCELLANEOUS--I										
Electric power conversion	92.26	14.01	41.87	1.52	1.12	0.82	2.96	6.22	0	0
Electricity transmission	0	0	5.72	0.21	0.05	0.04	0.70	1.47	0	0
Energy storage	0.89	0.14	27.59	1.00	0.34	0.25	0	0	0	0
TOTAL MISCELLANEOUS--I	93.16	14.15	75.19	2.72	1.51	1.11	3.66	7.68	0	0
MISCELLANEOUS--II										
Energy systems analysis	105.73	16.06	0.05	0	2.48	1.82	1.61	3.38	0	0
Others	173.69	26.38	17.91	0.65	20.44	15.01	6.14	12.91	14.09	21.87
TOTAL MISCELLANEOUS--II	279.42	42.44	17.96	0.65	22.92	16.83	7.75	16.29	14.09	21.87
TOTAL ENERGY R&D BUDGET	658.36	100.00	2,763.06	100.00	136.20	100.00	47.58	100.00	64.42	100.00

Source: Based on information from International Energy Agency, Energy Policies of IEA Countries, Paris, 1991, 154-57.

TABLE 9. GOVERNMENT R&D BUDGETS FOR ENERGY, BY SUBCOMPONENT, 1989
(In millions of 1990 U.S. dollars and percentage)

Group Technology Area	\$ Sweden %	\$ Switzerland %	\$ Taiwan \$	United Kingdom \$	United Kingdom %
OIL & GAS					
Enhanced oil & gas	0	0	0	n.a.	1.42
Refining transp. (O&G)	0.65	0.65	0	n.a.	1.66
Oil share [sic] & tar sands	0	0	0	n.a.	0
Other	3.21	3.20	5.69	n.a.	14.36
TOTAL OIL & GAS	3.86	3.85	5.69	n.a.	5.30
COAL					
Coal prod. prep. & transport	0.43	0.43	0	n.a.	0.08
Coal combustion	0	0	0.64	0.60	n.a.
Coal conversion	0	0	0	n.a.	0.66
Other	3.02	3.01	0	n.a.	1.90
TOTAL COAL	3.45	3.44	0.64	0.60	1.43
SOLAR					
Solar heating & cooling	6.96	6.94	4.41	4.17	n.a.
Solar photo electric	0.38	0.38	6.20	5.86	n.a.
Solar thermal electric	0	0	1.98	1.87	n.a.
TOTAL SOLAR	7.34	7.32	12.59	11.91	n.a.
				3.31	1.00

Group Technology Area	\$	Sweden %	\$	Switzerland %	\$	Taiwan \$	\$	United Kingdom %
OTHER NEW SOURCES								
Wind	6.58	6.56	0.45	0.42	n.a.	n.a.	9.34	2.84
Ocean	0	0	0	0	n.a.	n.a.	2.08	0.63
Biomass	7.08	7.06	2.43	2.30	n.a.	n.a.	3.63	1.10
Geothermal	0.34	0.34	3.64	3.45	n.a.	n.a.	6.06	1.84
TOTAL SOLAR & OTHER NEW SOURCES	21.34	21.28	19.10	18.08	n.a.	n.a.	24.40	7.41
MISCELLANEOUS--I								
Electric power conversion	2.06	2.05	3.19	3.02	n.a.	n.a.	0	0
Electricity transmission	0	0	3.19	3.02	n.a.	n.a.	0	0
Energy storage	0	0	8.24	7.80	n.a.	n.a.	0	0
TOTAL MISCELLANEOUS--I	2.06	2.05	14.63	13.85	n.a.	n.a.	0	0
MISCELLANEOUS--II								
Energy systems analysis	1.29	1.28	6.13	5.80	n.a.	n.a.	0.10	0.03
Others	19.35	19.30	1.79	1.69	n.a.	n.a.	5.02	1.52
TOTAL MISCELLANEOUS--II	20.64	20.58	7.92	7.50	n.a.	n.a.	5.12	1.56
TOTAL ENERGY R&D BUDGET	100.28	100.00	105.68	100.00	n.a.	n.a.	329.13	100.00

Source: Based on information from International Energy Agency, Energy Policies of IEA Countries, Paris, 1991, 154-57.

TABLE 10. GOVERNMENT R&D BUDGETS FOR ENERGY, BY SUBCOMPONENT, 1990
(In millions of 1990 U.S. dollars and percentage)

Group Technology Area	Australia \$ %	Denmark* \$ %	France \$ %	Germany \$ %	Indonesia \$ %
OIL & GAS					
Enhanced oil & gas	n.a.	n.a.	0	0	n.a.
Refining transp. (o&g)	n.a.	n.a.	0	0	n.a.
Oil share [sic] & tar sands	n.a.	n.a.	0	0	n.a.
Other	n.a.	n.a.	0	0	n.a.
TOTAL OIL & GAS	n.a.	3.56	9.28	n.a.	13.24
COAL					
Coal prod. prep. & transport	n.a.	n.a.	0	0	n.a.
Coal combustion	n.a.	n.a.	4.04	10.55	n.a.
Coal conversion	n.a.	n.a.	0	0	n.a.
Other	n.a.	n.a.	0	0	n.a.
TOTAL COAL	n.a.	4.04	10.55	n.a.	23.08
SOLAR					
Solar heating & cooling	n.a.	n.a.	2.42	6.33	n.a.
Solar photo electric	n.a.	n.a.	0	0	n.a.
Solar thermal electric	n.a.	n.a.	0	0	n.a.
TOTAL SOLAR	n.a.	2.42	6.33	n.a.	86.77

Group Technology Area	Australia \$ %	Denmark* \$ %	France \$ %	Germany \$ %	Indonesia \$ %
OTHER NEW SOURCES					
Wind	n.a.	n.a.	4.04	10.55	n.a.
Ocean	n.a.	n.a.	0.48	1.27	n.a.
Biomass	n.a.	n.a.	1.62	4.22	n.a.
Geothermal	n.a.	n.a.	0	0	n.a.
TOTAL SOLAR & OTHER NEW SOURCES	n.a.	n.a.	8.57	22.36	n.a.
MISCELLANEOUS--I					
Electric power conversion	n.a.	n.a.	0.97	2.53	n.a.
Electricity transmission	n.a.	n.a.	0	0	n.a.
Energy storage	n.a.	n.a.	3.88	10.13	n.a.
TOTAL MISCELLANEOUS--I	n.a.	n.a.	4.85	12.66	n.a.
MISCELLANEOUS--II					
Energy systems analysis	n.a.	n.a.	1.62	4.22	n.a.
Others	n.a.	n.a.	0	0	n.a.
TOTAL MISCELLANEOUS--II	n.a.	n.a.	1.62	4.22	n.a.
TOTAL ENERGY R&D BUDGET	n.a.	n.a.	38.31	100.00	n.a.
				534.41	100.00
					n.a.
					n.a.

*Figures as given in the original.

Source: Based on information from International Energy Agency, Energy Policies of IEA Countries, Paris, 1991, 150-53.

TABLE 11. GOVERNMENT R&D BUDGETS FOR ENERGY, BY SUBCOMPONENT, 1990
(In millions of 1990 U.S. dollars and percentage)

Group Technology Area	Italy \$ %	Japan \$ %	Netherlands* \$ %	Norway \$ %	Spain \$ %
OIL & GAS					
Enhanced oil & gas	0 0	2.97 0.12	0 0	3.29 6.25	0 0
Refining transp. (o&g)	0 0	65.23 2.57	0 0	4.07 7.74	0 0
Oil share [sic] & tar sands	0 0	0.14 0.01	0 0	0 0	0 0
Other	0 0	3.17 0.12	0 0	11.19 21.25	0 0
TOTAL OIL & GAS	0 0	71.51 2.82	0.55 0.36	18.55 35.25	0 0
COAL					
Coal prod. prep. & transport	0.17 0.02	14.42 0.57	0 0	0 0	2.75 4.59
Coal combustion	0.17 0.02	25.68 1.01	0 0	0.11 0.21	4.10 6.86
Coal conversion	0.13 0.02	170.45 6.71	0 0	0 0	0 0
Other	0 0	5.11 0.20	0 0	0 0	1.05 1.75
TOTAL COAL	0.46 0.06	215.67 8.49	0 0	1.36 2.58	0.96 1.61
SOLAR					
Solar heating & cooling	0.38 0.05	2.19 0.09	0 0	1.36 2.58	0.96 1.61
Solar photo electric	22.53 2.84	48.39 1.91	0 0	0 0	1.20 2.00
Solar thermal electric	0 0	0 0	0 0	0 0	0.20 0.33
TOTAL SOLAR	22.91 2.89	50.58 1.99	7.69 5.00	1.36 2.58	2.35 3.94

Group Technology Area	\$	Italy %	\$	Japan %	\$	Netherlands ^a %	\$	Norway %	\$	Spain %
OTHER NEW SOURCES										
Wind	22.53	2.84	2.53	0.10	0	0	1.41	2.67	0.63	1.05
Ocean	0	0	0.70	0.03	0	0	0.61	1.15	0	0
Biomass	10.01	1.26	5.38	0.21	0	0	1.92	3.64	4.08	6.82
Geothermal	0	0	37.14	1.46	0	0	0	0	0.91	1.53
TOTAL SOLAR & OTHER NEW SOURCES	55.45	6.99	96.34	3.79	21.86	14.29	5.29	10.05	7.98	13.33
MISCELLANEOUS--I										
Electric power conversion	107.40	13.55	43.32	1.71	0	0	3.91	7.44	8.10	13.55
Electricity transmission	0	0	5.69	0.22	0	0	1.01	1.91	2.30	3.84
Energy storage	1.50	0.19	28.07	1.11	0	0	0.05	0.09	0	0
TOTAL MISCELLANEOUS--I	108.90	13.74	77.09	3.04	1.65	1.07	4.97	9.44	10.40	17.39
MISCELLANEOUS--II										
Energy systems analysis	133.51	16.84	0.06	0	0	n.a. ^b	2.21	4.19	0	0
Others	216.96	27.37	17.40	0.69	0	0	7.09	13.48	0	0
TOTAL MISCELLANEOUS--II	350.47	44.21	17.45	0.69	25.81	16.79	9.30	17.67	0	0
TOTAL ENERGY R&D BUDGET	792.74	100.00	2,539.50	100.00	153.78	100.00	52.63	100.00	59.81	100.00

^aFigures as given in the original.

^bFigure missing in the original.

Source: Based on information from International Energy Agency, Energy Policies of IEA Countries, Paris, 1991, 150-53.

TABLE 12. GOVERNMENT R&D BUDGETS FOR ENERGY, BY SUBCOMPONENT, 1990
(In millions of 1990 U.S. dollars and percentage)

Group Technology Area	\$ Sweden %	\$ Switzerland %	\$ Taiwan %	United Kingdom \$	United Kingdom %
OIL & GAS					
Enhanced oil & gas	0	0	0	n.a.	1.24
Refining transp. (o&g)	1.13	1.14	0	n.a.	0.71
Oil share [sic] & tar sands	0	0	0	n.a.	0
Other	3.24	3.25	7.20	5.65	14.74
TOTAL OIL & GAS	4.38	4.39	7.20	5.65	5.71
COAL					
Coal prod. prep. & transport	0.42	0.42	0	0	0.07
Coal combustion	0	0	0.50	0.40	1.28
Coal conversion	0	0	0	0	1.65
Other	3.02	3.03	0	0	0.92
TOTAL COAL	3.45	3.46	0.50	0.40	3.93
SOLAR					
Solar heating & cooling	7.37	7.39	5.76	4.52	3.37
Solar photo electric	0.37	0.37	8.64	6.78	0
Solar thermal electric	0	0	2.74	2.15	0
TOTAL SOLAR	7.74	7.76	17.14	13.45	1.15

Group Technology Area	\$	Sweden %	\$	Switzerland %	\$	Taiwan %	\$	United Kingdom %
OTHER NEW SOURCES								
Wind	4.76	4.78	0.36	0.28	n.a.	n.a.	13.14	4.50
Ocean	0	0	0	0	n.a.	n.a.	3.02	1.03
Biomass	6.42	6.44	3.24	2.54	n.a.	n.a.	4.62	1.58
Geothermal	0.34	0.34	3.60	2.82	n.a.	n.a.	4.80	1.64
TOTAL SOLAR & OTHER NEW SOURCES	19.26	19.32	24.34	19.10	n.a.	n.a.	28.95	9.91
MISCELLANEOUS-I								
Electric power conversion	2.01	2.02	4.32	3.39	n.a.	n.a.	1.42	0.49
Electricity transmission	0	0	4.32	3.39	n.a.	n.a.	0	0
Energy storage	0	0	10.08	7.91	n.a.	n.a.	0	0
TOTAL MISCELLANEOUS-I	2.01	2.02	18.72	14.69	n.a.	n.a.	1.42	0.49
MISCELLANEOUS-II								
Energy systems analysis	1.27	1.27	7.20	5.65	n.a.	n.a.	0.21	0.07
Others	20.06	20.12	2.16	1.69	n.a.	n.a.	7.64	2.61
TOTAL MISCELLANEOUS-II	21.32	21.39	9.36	7.34	n.a.	n.a.	7.85	2.69
TOTAL ENERGY R&D BUDGET	99.69	100.00	127.45	100.00	n.a.	n.a.	292.22	100.00

Source: Based on information from International Energy Agency, Energy Policies of IEA Countries, Paris, 1991, 150-53.

TABLE 13. ACTUAL IEA GOVERNMENT ENERGY R&D EXPENDITURES BY COUNTRY, BY SUBCOMPONENT, 1992
(In millions of the national currency and percentage)

Group Technology Area	Australia	Denmark	France	Germany	Indonesia
	\$ %	\$ %	\$ %	\$ %	\$ %
CONSERVATION					
TOTAL CONSERVATION	n.a.	n.a.	n.a.	19.31	3.40
OIL & GAS				13.28	2.83
Enhanced oil & gas	n.a.	n.a.	n.a.	0	7.25
Refining transp. (O&G)	n.a.	n.a.	n.a.	0	0
Oil share [sic] & tar sands	n.a.	n.a.	n.a.	0	0
Other	n.a.	n.a.	n.a.	38.05	6.70
TOTAL OIL & GAS	n.a.	n.a.	n.a.	38.05	6.70
COAL					
Coal prod. prep. & transport	n.a.	n.a.	n.a.	0.57	0.10
Coal combustion	n.a.	n.a.	n.a.	3.60	0.63
Coal conversion	n.a.	n.a.	n.a.	0.57	0.10
Other	n.a.	n.a.	n.a.	0.95	0.17
TOTAL COAL	n.a.	n.a.	n.a.	5.68	1.00
SOLAR					
Solar heating & cooling	n.a.	n.a.	n.a.	0.17	0.03
Solar photo electric	n.a.	n.a.	n.a.	2.42	0.43
Solar thermal electric	n.a.	n.a.	n.a.	0	0
TOTAL SOLAR	n.a.	n.a.	n.a.	2.59	0.46

Group Technology Area	Australia	Denmark	France	Germany	Indonesia
	\$ %	\$ %	\$ %	\$ %	\$ %
OTHER NEW SOURCES					
Wind	n.a.	n.a.	0.74	0.13	16.48
Ocean	n.a.	n.a.	0	0	0
Biomass	n.a.	n.a.	2.40	0.42	11.93
Geothermal	n.a.	n.a.	2.37	0.42	3.21
Hydro: large and small	n.a.	n.a.	0.27	0.05	0
TOTAL SOLAR AND OTHER NEW SOURCES	n.a.	n.a.	8.37	1.47	128.16
NUCLEAR					
TOTAL NUCLEAR	n.a.	n.a.	n.a.	496.77	87.44
MISCELLANEOUS-I					
Electric power conversion	n.a.	n.a.	0	0	0
Electricity transmission	n.a.	n.a.	0	0	1.48
Energy storage	n.a.	n.a.	0	0	3.66
TOTAL MISCELLANEOUS-I	n.a.	n.a.	0	5.13	1.09
MISCELLANEOUS-II					
Energy systems analysis	n.a.	n.a.	0	0	5.84
Others	n.a.	n.a.	0	0	0
TOTAL MISCELLANEOUS-II	n.a.	n.a.	0	5.84	1.25
TOTAL ENERGY R&D BUDGET	79.34	100.00	n.a.	568.15	100.00
				468.76	100.00

Source: Based on information from International Energy Agency, Energy Policies of IEA Countries, Paris, 1994, n.p.

TABLE 14. ACTUAL IEA GOVERNMENT ENERGY R&D EXPENDITURES BY COUNTRY, BY SUBCOMPONENT, 1992
(In millions of the national currency and percentage)

Group Technology Area	Technology	Italy	\$	Japan	\$	Netherlands	\$	Norway	\$	Spain	%
CONSERVATION											
	TOTAL CONSERVATION	n.a.	n.a.	n.a.	n.a.	45.11	26.44	14.90	23.50	14.87	13.82
Oil & GAS											
Enhanced oil & gas	n.a.	n.a.	n.a.	n.a.	5.75	3.37	3.69	5.82	0	0	0
Refining transp. (O&G)	n.a.	n.a.	n.a.	n.a.	0	0	2.43	3.83	0	0	0
Oil share (sic) & tar sands	n.a.	n.a.	n.a.	n.a.	0	0	0	0	0	0	0
Other	n.a.	n.a.	n.a.	n.a.	1.37	0.80	11.95	18.86	0	0	0
TOTAL OIL & GAS	n.a.	n.a.	n.a.	n.a.	7.12	4.17	18.07	28.50	0	0	0
COAL											
Coal prod. prep. & transport	n.a.	n.a.	n.a.	n.a.	0.17	0.10	0	0	0.24	0.22	0.22
Coal combustion	n.a.	n.a.	n.a.	n.a.	1.59	0.93	0.11	0.18	0	0	0
Coal conversion	n.a.	n.a.	n.a.	n.a.	2.62	1.54	0	0	1.49	1.38	1.38
Other	n.a.	n.a.	n.a.	n.a.	3.08	1.80	0	0	1.14	1.06	1.06
TOTAL COAL	n.a.	n.a.	n.a.	n.a.	7.46	4.37	0.11	0.18	2.86	2.66	2.66
SOLAR											
Solar heating & cooling	n.a.	n.a.	n.a.	n.a.	1.94	1.13	2.20	3.47	1.28	1.19	1.19
Solar photo electric	n.a.	n.a.	n.a.	n.a.	9.40	5.51	0.16	0.26	1.79	1.66	1.66
Solar thermal electric	n.a.	n.a.	n.a.	n.a.	0	0	0	0	6.97	6.48	6.48
TOTAL SOLAR	n.a.	n.a.	n.a.	n.a.	11.34	6.64	2.36	3.73	10.04	9.33	9.33

Group Technology Area	Italy \$	Italy %	Japan \$	Japan %	Netherlands \$	Netherlands %	Norway \$	Norway %	Spain \$	Spain %
OTHER NEW SOURCES										
Wind	n.a.	n.a.	n.a.	n.a.	6.61	3.87	1.94	3.06	2.00	1.86
Ocean	n.a.	n.a.	n.a.	n.a.	0	0	0.87	1.38	0	0
Biomass	n.a.	n.a.	n.a.	n.a.	2.85	1.67	2.22	3.50	7.46	6.94
Geothermal	n.a.	n.a.	n.a.	n.a.	0.46	0.27	0	0	0.28	0.26
Hydro: large and small	n.a.	n.a.	n.a.	n.a.	0	0	3.83	6.05	7.14	6.64
TOTAL SOLAR & OTHER NEW SOURCES	n.a.	n.a.	n.a.	n.a.	21.25	12.45	11.23	17.71	26.91	25.02
NUCLEAR										
TOTAL NUCLEAR	n.a.	n.a.	n.a.	n.a.	58.67	34.38	8.41	13.27	38.27	35.58
MISCELLANEOUS--I										
Electric power conversion	n.a.	n.a.	n.a.	n.a.	18.17	10.65	0	0	0	0
Electricity transmission	n.a.	n.a.	n.a.	n.a.	2.05	1.20	2.91	4.59	0	0
Energy storage	n.a.	n.a.	n.a.	n.a.	0.68	0.40	0.08	0.13	0	0
TOTAL MISCELLANEOUS--I	n.a.	n.a.	n.a.	n.a.	20.90	12.25	2.99	4.72	0	0
MISCELLANEOUS--II										
Energy systems analysis	n.a.	n.a.	n.a.	n.a.	4.27	2.50	2.18	3.44	24.66	22.92
Others	n.a.	n.a.	n.a.	n.a.	5.87	3.44	5.50	8.68	0	0
TOTAL MISCELLANEOUS--II	n.a.	n.a.	n.a.	n.a.	10.14	5.94	6.78	12.12	24.66	22.92
TOTAL ENERGY R&D BUDGET	n.a.	n.a.	n.a.	n.a.	170.65	100.00	63.39	100.00	107.57	100.00

Source: Based on information from International Energy Agency, Energy Policies of IEA Countries, Paris, 1994, n.p.

TABLE 15. ACTUAL IEA GOVERNMENT ENERGY R&D BUDGETS BY COUNTRY, BY SUBCOMPONENT, 1992
(In millions of the national currency and percentage)

Group Technology Area	\$	Sweden %	\$	Switzerland %	\$	Taiwan \$	\$	United Kingdom %
CONSERVATION								
TOTAL CONSERVATION	43.49	33.45	22.84	15.24	n.a.	n.a.	30.61	13.05
OIL & GAS								
Enhanced oil & gas	0	0	0	0	n.a.	n.a.	0.70	0.30
Refining transp. (O&G)	1.03	0.79	0	0	n.a.	n.a.	0	0
Oil share [sic] & tar sands	0	0	0	0	n.a.	n.a.	0	0
Other	0.47	0.36	11.42	7.62	n.a.	n.a.	5.63	2.40
TOTAL OIL & GAS	1.50	1.16	11.42	7.62	n.a.	n.a.	6.33	2.70
COAL								
Coal prod. prep. & transport	0.40	0.31	0	0	n.a.	n.a.	1.23	0.52
Coal combustion	0	0	0.71	0.48	n.a.	n.a.	3.43	1.46
Coal conversion	0	0	0	0	n.a.	n.a.	0.79	0.34
Other	1.52	1.17	0	0	n.a.	n.a.	1.58	0.67
TOTAL COAL	1.92	1.48	0.71	0.48	n.a.	n.a.	7.03	3.00
SOLAR								
Solar heating & cooling	5.32	4.09	7.85	5.24	n.a.	n.a.	3.69	1.57
Solar photo electric	0.30	0.23	11.42	7.62	n.a.	n.a.	0.35	0.15
Solar thermal electric	0	0	5.00	3.33	n.a.	n.a.	0	0
TOTAL SOLAR	5.60	4.31	24.27	16.19	n.a.	n.a.	4.04	1.72

Group Technology Area	\$	Sweden %	\$	Switzerland %	\$	Taiwan \$	\$	United Kingdom %
OTHER NEW SOURCES								
Wind	4.16	3.20	0.36	0.24	n.a.	n.a.	16.00	6.82
Ocean	0.09	0.07	0	0	n.a.	n.a.	0.53	0.22
Biomass	25.11	19.31	5.00	3.33	n.a.	n.a.	5.63	2.40
Geothermal	0.21	0.16	3.93	2.62	n.a.	n.a.	1.93	0.82
Hydro: large and small	0	0	9.28	6.19	n.a.	n.a.	0.18	0.07
TOTAL SOLAR & OTHER NEW SOURCES	35.16	27.04	33.55	22.38	n.a.	n.a.	28.31	12.06
NUCLEAR								
TOTAL NUCLEAR	19.76	15.20	49.97	33.33	n.a.	n.a.	153.20	65.30
MISCELLANEOUS--I								
Electric power conversion	2.57	1.98	7.14	4.76	n.a.	n.a.	1.93	0.82
Electricity transmission	0	0	3.57	2.38	n.a.	n.a.	0.88	0.37
Energy storage	0	0	10.71	7.14	n.a.	n.a.	0	0
TOTAL MISCELLANEOUS--I	2.57	1.98	21.41	14.29	n.a.	n.a.	2.81	1.20
MISCELLANEOUS--II								
Energy systems analysis	2.17	1.67	7.85	5.24	n.a.	n.a.	0	0
Others	23.43	18.02	2.14	1.43	n.a.	n.a.	6.33	2.70
TOTAL MISCELLANEOUS--II	25.60	19.69	9.99	6.67	n.a.	n.a.	6.33	2.70
TOTAL ENERGY R&D BUDGET	130.02	100.00	149.90	100.00	n.a.	n.a.	234.62	100.00

Source: Based on information from International Energy Agency, Energy Policies of IEA Countries, Paris, 1994, n.p.

TABLE 16. IEA GOVERNMENT ENERGY R&D EXPENDITURES BY COUNTRY, BY SUBCOMPONENT, 1993
(In millions of the national currency and percentage)

Group Technology Area	Australia \$	Australia %	Denmark \$	Denmark %	France \$	France %	Germany \$	Germany %	Indonesia \$	Indonesia %
CONSERVATION										
TOTAL CONSERVATION	n.a.	n.a.	6.63	14.24	17.84	3.22	13.07	3.11	n.a.	n.a.
OIL & GAS										
Enhanced oil & gas	n.a.	n.a.	1.08	2.32	0	0	7.86	1.87	n.a.	n.a.
Refining transp. (O&G)	n.a.	n.a.	0.31	0.66	0	0	0	0	n.a.	n.a.
Oil share [sic] & tar sands	n.a.	n.a.	0	0	0	0	0	0	n.a.	n.a.
Other	n.a.	n.a.	1.54	3.31	34.61	6.26	0	0	n.a.	n.a.
TOTAL OIL & GAS	n.a.	n.a.	2.93	6.29	34.61	6.26	7.86	1.87	n.a.	n.a.
COAL										
Coal prod. prep. & transport	n.a.	n.a.	0	0	0.53	0.10	1.81	0.43	n.a.	n.a.
Coal combustion	n.a.	n.a.	3.24	6.95	3.36	0.61	24.20	5.76	n.a.	n.a.
Coal conversion	n.a.	n.a.	0	0	0.53	0.10	0	0	n.a.	n.a.
Other	n.a.	n.a.	1.85	3.97	0.88	0.16	5.32	1.27	n.a.	n.a.
TOTAL COAL	n.a.	n.a.	5.09	10.93	5.30	0.96	31.34	7.45	n.a.	n.a.
SOLAR										
Solar heating & cooling	n.a.	n.a.	4.17	8.94	0.16	0.03	18.45	4.39	n.a.	n.a.
Solar photo electric	n.a.	n.a.	0.31	0.66	2.17	0.39	58.68	13.96	n.a.	n.a.
Solar thermal electric	n.a.	n.a.	0	0	0	0	3.69	0.88	n.a.	n.a.
TOTAL SOLAR	n.a.	n.a.	4.47	9.60	2.33	0.42	80.82	19.23	n.a.	n.a.

Group Technology Area	\$ %	Australia	\$ %	Denmark	\$ %	France	\$ %	Germany	\$ %	Indonesia	\$ %
OTHER NEW SOURCES											
Wind	n.a.	6.94	14.90	0.65	0.12	21.78	5.18	n.a.	n.a.	n.a.	n.a.
Ocean	n.a.	0.62	1.32	0	0	0	0	0	0	n.a.	n.a.
Biomass	n.a.	8.02	17.22	2.47	0.45	6.65	1.58	n.a.	n.a.	n.a.	n.a.
Geothermal	n.a.	0	0	2.12	0.38	3.63	0.86	n.a.	n.a.	n.a.	n.a.
Hydro: large and small	n.a.	0	0	0.23	0.04	0	0	n.a.	n.a.	n.a.	n.a.
TOTAL SOLAR AND OTHER NEW SOURCES	n.a.	20.06	43.05	7.81	1.41	112.89	26.85	n.a.	n.a.		
NUCLEAR											
TOTAL NUCLEAR	n.a.	n.a.	2.01	4.30	487.79	88.16	232.97	55.42	n.a.	n.a.	
MISCELLANEOUS-I											
Electric power conversion	n.a.	n.a.	5.09	10.93	0	0	0	0	0	n.a.	n.a.
Electricity transmission	n.a.	n.a.	0	0	0	0	0	1.94	0.46	n.a.	n.a.
Energy storage	n.a.	n.a.	0.31	0.66	0	0	4.30	1.02	n.a.	n.a.	n.a.
TOTAL MISCELLANEOUS-I	n.a.	n.a.	5.40	11.59	0	0	6.23	1.48	n.a.	n.a.	
MISCELLANEOUS-II											
Energy systems analysis	n.a.	n.a.	2.31	4.97	0	0	2.96	0.71	n.a.	n.a.	n.a.
Others	n.a.	n.a.	2.16	4.64	0	0	0	0	n.a.	n.a.	n.a.
TOTAL MISCELLANEOUS-II	n.a.	n.a.	4.47	9.60	0	0	2.96	0.71	n.a.	n.a.	
TOTAL ENERGY R&D BUDGET	n.a.	n.a.	46.59	100.00	553.31	100.00	420.39	100.00	n.a.	n.a.	

Source: Based on information from International Energy Agency, Energy Policies of IEA Countries, Paris, 1994, n.p.

TABLE 17. IEA GOVERNMENT ENERGY R&D EXPENDITURES BY COUNTRY, BY SUBCOMPONENT, 1993
 (In millions of the national currency and percentage)

Group Technology Area	\$	Italy %	\$	Japan %	\$	Netherlands %	\$	Norway %	\$	Spain %
CONSERVATION										
TOTAL CONSERVATION	n.a.	n.a.	24.25	0.48	40.01	26.54	12.69	24.56	17.04	16.68
OIL & GAS										
Enhanced oil & gas	n.a.	n.a.	7.57	0.15	5.49	3.64	2.89	5.59	0	0
Refining transp. (O&G)	n.a.	n.a.	111.75	2.22	0	0	1.02	1.96	0	0
Oil share [sic] & tar sands	n.a.	n.a.	0	0	0	0	0	0	0	0
Other	n.a.	n.a.	5.26	0.10	1.29	0.86	10.22	19.78	0	0
TOTAL OIL & GAS	n.a.	n.a.	124.59	2.47	6.78	4.50	14.13	27.34	0	0
COAL										
Coal prod. prep. & transport	n.a.	n.a.	29.03	0.58	0.22	0.14	0	0	0	0
Coal combustion	n.a.	n.a.	87.01	1.73	0.86	0.57	0.10	0.19	0	0
Coal conversion	n.a.	n.a.	161.20	3.20	1.88	1.25	0	0	1.35	1.32
Other	n.a.	n.a.	5.28	0.10	2.58	1.71	0	0	0.67	0.66
TOTAL COAL	n.a.	n.a.	282.51	5.61	5.55	3.68	0.10	0.19	2.02	1.98
SOLAR										
Solar heating & cooling	n.a.	n.a.	5.15	0.10	2.69	1.79	1.66	3.22	1.08	1.06
Solar photo electric	n.a.	n.a.	63.72	1.27	7.48	4.96	0.14	0.27	4.15	4.07
Solar thermal electric	n.a.	n.a.	0.0	0.0	0	0	0	0	6.39	6.26
TOTAL SOLAR	n.a.	n.a.	68.88	1.37	10.18	6.75	1.80	3.49	11.63	11.39

Group Technology Area	\$	Italy %	\$	Japan %	\$	Netherlands %	\$	Norway %	\$	Spain %
OTHER NEW SOURCES										
Wind	n.a.	n.a.	8.79	0.17	6.35	4.21	0.61	1.17	3.45	3.38
Ocean	n.a.	n.a.	0.15	0.00	0	0	0.42	0.82	0	0
Biomass	n.a.	n.a.	0.24	0.00	1.40	0.93	1.86	3.60	8.22	8.05
Geothermal	n.a.	n.a.	41.38	0.82	1.08	0.71	0	0	0.11	0.11
Hydro: large and small	n.a.	n.a.	0.0	0.0	0.16	0.11	3.24	6.28	6.63	6.49
TOTAL SOLAR & OTHER NEW SOURCES	n.a.	n.a.	188.33	3.74	19.17	12.71	7.94	15.36	30.03	29.41
NUCLEAR										
TOTAL NUCLEAR	n.a.	n.a.	4,257.29	84.55	47.22	31.32	7.51	14.54	32.25	31.58
MISCELLANEOUS--I										
Electric power conversion	n.a.	n.a.	96.76	1.92	20.41	13.54	0	0	0	0
Electricity transmission	n.a.	n.a.	5.22	0.10	2.05	1.36	2.54	4.91	0	0
Energy storage	n.a.	n.a.	7.11	0.14	1.02	0.68	0.07	0.14	0	0
TOTAL MISCELLANEOUS--I	n.a.	n.a.	109.09	2.17	23.48	15.57	2.61	5.05	0	0
MISCELLANEOUS--II										
Energy systems analysis	n.a.	n.a.	0.27	0.01	4.09	2.71	1.90	3.68	20.78	20.35
Others	n.a.	n.a.	48.63	0.97	4.42	2.93	4.79	9.28	0	0
TOTAL MISCELLANEOUS--II	n.a.	n.a.	48.90	0.97	8.51	5.64	6.70	12.96	20.78	20.35
TOTAL ENERGY R&D BUDGET	n.a.	n.a.	5,034.96	100.0	150.76	100.00	51.67	100.00	102.12	100.00

Source: Based on information from International Energy Agency, Energy Policies of IEA Countries, Paris, 1994, n.p.

TABLE 18. IEA GOVERNMENT ENERGY R&D EXPENDITURES BY COUNTRY, BY SUBCOMPONENT, 1993
(In millions of the national currency and percentage)

Group Technology Area	Sweden \$ %	Switzerland \$ %	Taiwan \$	United Kingdom \$ %
CONSERVATION				
TOTAL CONSERVATION	25.66	34.93	23.69	15.91
OIL & GAS				
Enhanced oil & gas	0	0	0	n.a.
Refining transp. (O&G)	0.03	0.03	0	n.a.
Oil share [sic] & tar sands	0	0	0	n.a.
Other	0	0	10.83	7.27
TOTAL OIL & GAS	0.03	0.03	10.83	7.27
COAL				
Coal prod. prep. & transport	0.26	0.35	0	n.a.
Coal combustion	0	0	0.68	0.45
Coal conversion	0	0	0	n.a.
Other	0.51	0.70	0	n.a.
TOTAL COAL	0.77	1.05	0.68	0.45
SOLAR				
Solar heating & cooling	2.17	2.95	8.12	5.45
Solar photo electric	0.44	0.59	11.51	7.73
Solar thermal electric	0	0	5.42	3.64
TOTAL SOLAR	2.61	3.55	25.05	16.82

Group Technology Area	\$	Sweden %	\$	Switzerland %	\$	Taiwan %	\$	United Kingdom %
OTHER NEW SOURCES								
Wind	3.56	4.84	0.34	0.23	n.a.	n.a.	12.31	6.91
Ocean	0.08	0.10	0	0	n.a.	n.a.	0.75	0.42
Biomass	6.87	9.35	5.42	3.64	n.a.	n.a.	4.35	2.44
Geothermal	0.15	0.21	3.72	2.50	n.a.	n.a.	1.50	0.84
Hydro: large and small	0	0	9.48	6.36	n.a.	n.a.	0.15	0.08
TOTAL SOLAR & OTHER NEW SOURCES	13.27	18.06	34.52	23.18	n.a.	n.a.	22.67	12.73
NUCLEAR								
TOTAL NUCLEAR	15.12	20.58	48.06	32.27	n.a.	n.a.	104.23	58.52
MISCELLANEOUS--I								
Electric power conversion	3.64	4.95	7.45	5.00	n.a.	n.a.	2.10	1.18
Electricity transmission	0	0	3.38	2.27	n.a.	n.a.	0.75	0.42
Energy storage	0	0	10.15	6.82	n.a.	n.a.	0.60	0.34
TOTAL MISCELLANEOUS--I	3.64	4.95	20.98	14.09	n.a.	n.a.	3.45	1.94
MISCELLANEOUS--II								
Energy systems analysis	1.49	2.03	8.12	5.45	n.a.	n.a.	0	0
Others	13.51	18.39	2.03	1.36	n.a.	n.a.	5.86	3.29
TOTAL MISCELLANEOUS--II	14.99	20.40	10.15	6.82	n.a.	n.a.	5.86	3.29
TOTAL ENERGY R&D BUDGET	73.47	100.00	148.92	100.00	n.a.	n.a.	178.12	100.00

Source: Based on information from International Energy Agency, Energy Policies of IEA Countries, Paris, 1994, n.p.

TABLE 19. GOVERNMENT R&D BUDGETS FOR OIL AND GAS, 1989-93
(In millions of 1990 U.S. dollars)

Country	1989	1990	1991	1992	1993
Australia	19.2	n.a.	n.a.	n.a.	n.a.
Denmark	2.9	3.6	n.a.	n.a.	n.a.
France	n.a.	n.a.	n.a.	n.a.	n.a.
Germany	14.0	13.2	n.a.	n.a.	n.a.
Indonesia	n.a.	n.a.	n.a.	n.a.	n.a.
Italy	n.a.	n.a.	n.a.	n.a.	n.a.
Japan	59.2	71.5	n.a.	n.a.	n.a.
Netherlands	0.7	0.5	n.a.	n.a.	n.a.
Norway	22.4	18.6	n.a.	n.a.	n.a.
Spain	n.a.	n.a.	n.a.	n.a.	n.a.
Sweden	4.2	4.4	n.a.	n.a.	n.a.
Switzerland	6.7	7.2	n.a.	n.a.	n.a.
Taiwan	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	18.9	16.7	n.a.	n.a.	n.a.

Source: Based on information from International Energy Agency, Energy Policies of IEA Countries, Paris, 1991, 141.

TABLE 20. GOVERNMENT R&D BUDGETS FOR COAL, 1989-93
 (In millions of 1990 U.S. dollars)

Country	1989	1990	1991	1992	1993
Australia	16.6	n.a.	n.a.	n.a.	n.a.
Denmark	7.7	4.0	n.a.	n.a.	n.a.
France	n.a.	n.a.	n.a.	n.a.	n.a.
Germany	80.2	82.9	n.a.	n.a.	n.a.
Indonesia	n.a.	n.a.	n.a.	n.a.	n.a.
Italy	0.5	0.5	n.a.	n.a.	n.a.
Japan	219.3	215.7	n.a.	n.a.	n.a.
Netherlands	29.5	28.6	n.a.	n.a.	n.a.
Norway	0.1	0.1	n.a.	n.a.	n.a.
Spain	2.2	7.9	n.a.	n.a.	n.a.
Sweden	3.8	3.4	n.a.	n.a.	n.a.
Switzerland	0.8	0.5	n.a.	n.a.	n.a.
Taiwan	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	5.1	3.9	n.a.	n.a.	n.a.

Source: Based on information from International Energy Agency, Energy Policies of IEA Countries, Paris, 1991, 142.

TABLE 21. GOVERNMENT-FINANCED RESEARCH ON RENEWABLE ENERGY SOURCES, 1989-93
(In millions of the national currency and percentage of total energy R&D)

Country	1989		1990		1991		1992		1993	
	Funds*	% ^d	Funds ^b	% ^e	Funds ^c	% ^c	Funds	%	Funds	%
Australia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
France	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Germany	192.7	12.7	237.6	15.8	283.3 ^f	18.6 ^f	n.a.	n.a.	n.a.	n.a.
Indonesia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Italy	110,794	20.6	117,231	20.7	87,454	16.0	n.a.	n.a.	n.a.	n.a.
Japan	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Netherlands	5.2	3.3	6.4	4.0	5.9	3.7	n.a.	n.a.	n.a.	n.a.
Norway	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Spain	n.a.	n.a.	n.a.	n.a.	1,261	17.9	n.a.	n.a.	n.a.	n.a.
Sweden	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Switzerland	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Taiwan	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom ^g	17.3	10.9	20.0 ^h	13.1 ^h	22.9 ^h	18.1 ^h	22.7 ^h	20.1 ^h	21.9 ^{hp}	23.3 ^{hp}

See next page for footnotes.

Table 21. Continued

^aBased on information from Office des publications officielles des Communautés européennes, Öffentliche aufwendungen für forschung und entwicklung 1980-1990/Government Financing of Research and Development 1980-1990/Le financement public de la recherche et du développement 1980-1990, Luxembourg, 1991, 74-75.

^bBased on information from Office des publications officielles des Communautés européennes, Öffentliche aufwendungen für forschung und entwicklung 1980-1991/Government Financing of Research and Development 1980-1991/Le financement public de la recherche et du développement 1980-1991, Luxembourg, 1992, 160-61.

^cBased on information from Office des publications officielles des Communautés européennes, Forschung und entwicklung: jährliche statistiken 1993/Research and Development: Annual Statistics 1993/Recherche et développement: statistiques annuelles 1993, Luxembourg, 1993, 142-43.

^dBased on information from Office des publications officielles des Communautés européennes, Öffentliche aufwendungen für forschung und entwicklung 1980-1990/Government Financing of Research and Development 1980-1990/Le financement public de la recherche et du développement 1980-1990, Luxembourg, 1991, 86-87.

^eBased on information from Office des publications officielles des Communautés européennes, Öffentliche aufwendungen für forschung und entwicklung 1980-1991/Government Financing of Research and Development 1980-1991/Le financement public de la recherche et du développement 1980-1991, Luxembourg, 1992, 172-73.

^fIncludes the new *Länder*.

^gU.K. fiscal year begins 1 April.

^hBased on information from United Kingdom, the Office of Public Service and Science, Office of Science and Technology, Annual Review of Government Funded Research and Development 1993, London, 1993, 259.

ⁱEstimate.

^jProvisional. Actual figure to be published at a later date.

TABLE 22. GOVERNMENT R&D BUDGETS FOR RENEWABLE SOURCES OF ENERGY, 1989-93
(In millions of 1990 U.S. dollars)

Country	1989 ^a	1990 ^a	1991	1992	1993
Australia	4.5	n.a.	n.a.	n.a.	n.a.
Denmark	11.4	8.6	n.a.	n.a.	n.a.
France	n.a.	n.a.	n.a.	n.a.	n.a.
Germany	82.8	105.2	n.a.	n.a.	n.a.
Indonesia	n.a.	n.a.	n.a.	n.a.	n.a.
Italy	44.7	55.5	n.a.	n.a.	n.a.
Japan	96.4	96.3	n.a.	n.a.	n.a.
Netherlands	22.5	22.0	n.a.	n.a.	n.a.
Norway	3.3	5.3	n.a.	n.a.	n.a.
Spain	15.5	8.0	n.a.	n.a.	n.a.
Sweden	23.2	19.3	n.a.	n.a.	n.a.
Switzerland	22.5	24.3	n.a.	n.a.	n.a.
Taiwan	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	26.5	29.0	n.a.	n.a.	n.a.

Source: Based on information from International Energy Agency, Energy Policies of IEA Countries, Paris, 1991, 146.

TABLE 23. GOVERNMENT R&D BUDGETS FOR ELECTRICITY, 1989-93
 (In millions of 1990 U.S. dollars)

Country	1989	1990	1991	1992	1993
Australia	9.4	n.a.	n.a.	n.a.	n.a.
Denmark	3.0	4.8	n.a.	n.a.	n.a.
France	n.a.	n.a.	n.a.	n.a.	n.a.
Germany	8.3	9.1	n.a.	n.a.	n.a.
Indonesia	n.a.	n.a.	n.a.	n.a.	n.a.
Italy	106.6	108.9	n.a.	n.a.	n.a.
Japan	71.6	77.1	n.a.	n.a.	n.a.
Netherlands	1.8	1.6	n.a.	n.a.	n.a.
Norway	4.0	5.0	n.a.	n.a.	n.a.
Spain	n.a.	10.4	n.a.	n.a.	n.a.
Sweden	2.2	2.0	n.a.	n.a.	n.a.
Switzerland	17.2	18.7	n.a.	n.a.	n.a.
Taiwan	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	n.a.	1.4	n.a.	n.a.	n.a.

Source: Based on information from International Energy Agency, Energy Policies of IEA Countries, Paris, 1991, 148.

TABLE 24. GOVERNMENT R&D BUDGETS FOR ENERGY SYSTEMS ANALYSIS AND OTHER PROGRAMS, 1989-93
 (In millions of 1990 U.S. dollars)

Country	1989	1990	1991	1992	1993
Australia	1.6	n.a.	n.a.	n.a.	n.a.
Denmark	1.7	1.6	n.a.	n.a.	n.a.
France	n.a.	n.a.	n.a.	n.a.	n.a.
Germany	1.4	2.0	n.a.	n.a.	n.a.
Indonesia	n.a.	n.a.	n.a.	n.a.	n.a.
Italy	319.8	350.5	n.a.	n.a.	n.a.
Japan	17.1	17.5	n.a.	n.a.	n.a.
Netherlands	26.7	25.8	n.a.	n.a.	n.a.
Norway	8.5	9.3	n.a.	n.a.	n.a.
Spain	16.4	n.a.	n.a.	n.a.	n.a.
Sweden	22.5	21.3	n.a.	n.a.	n.a.
Switzerland	9.3	9.4	n.a.	n.a.	n.a.
Taiwan	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	5.6	7.9	n.a.	n.a.	n.a.

Source: Based on information from International Energy Agency, Energy Policies of IEA Countries, Paris, 1991, 149.

TABLE 25. GOVERNMENT-FINANCED RESEARCH ON FOSSIL FUELS AND THEIR DERIVATIVES, 1989-94
 (In millions of the national currency and percentage of total energy R&D)

Country	1989 Funds ^a % ^d	1990 Funds ^b % ^e	1991 Funds ^c % ^c	1992 Funds %	1993 Funds %
Australia	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	n.a.	n.a.	n.a.	n.a.	n.a.
France	n.a.	n.a.	n.a.	n.a.	n.a.
Germany	149.3	9.8	187.8	12.5	179.1 ^f
Indonesia	n.a.	n.a.	n.a.	n.a.	n.a.
Italy	3,042	0.6	3,289	0.6	2,923
Japan	n.a.	n.a.	n.a.	n.a.	n.a.
Netherlands	166.0	10.6	189.0	11.7	186.0
Norway	n.a.	n.a.	n.a.	n.a.	n.a.
Spain	n.a.	n.a.	n.a.	77	1.1
Sweden	n.a.	n.a.	n.a.	n.a.	n.a.
Switzerland	n.a.	n.a.	n.a.	n.a.	n.a.
Taiwan	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	5.0	3.1	15.3	10.2	7.8

See next page for footnotes.

Table 25. Continued

^aBased on information from Office des publications officielles des Communautés européennes, Öffentliche aufwendungen für forschung und entwicklung 1980-1990/Government Financing of Research and Development 1980-1990/Le financement public de la recherche et du développement 1980-1990, Luxembourg, 1991, 74-75.

^bBased on information from Office des publications officielles des Communautés européennes, Öffentliche aufwendungen für forschung und entwicklung 1980-1991/Government Financing of Research and Development 1980-1991/Le financement public de la recherche et du développement 1980-1991, Luxembourg, 1992, 160-61.

^cBased on information from Office des publications officielles des Communautés européennes, Forschung und entwicklung: jährliche statistiken 1993/Research and Development: Annual Statistics 1993/Recherche et développement: statistiques annuelles 1993, Luxembourg, 1993, 142-43.

^dBased on information from Office des publications officielles des Communautés européennes, Öffentliche aufwendungen für forschung und entwicklung 1980-1990/Government Financing of Research and Development 1980-1990/Le financement public de la recherche et du développement 1980-1990, Luxembourg, 1991, 86-87.

^eBased on information from Office des publications officielles des Communautés européennes, Öffentliche aufwendungen für forschung und entwicklung 1980-1991/Government Financing of Research and Development 1980-1991/Le financement public de la recherche et du développement 1980-1991, Luxembourg, 1992, 172-73.

^fIncludes the new *Länder*.

TABLE 26. GOVERNMENT-FINANCED GENERAL ENERGY RESEARCH, 1989-93
 (In millions of the national currency and percentage of total energy R&D)

Country	1989 Funds ^a	% ^d	1990 Funds ^b	% ^e	1991 Funds ^c	% ^e	1992 Funds	%	1993 Funds	%
Australia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
France	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Germany	50.3	3.3	44.4	2.9	44.5 ^f	2.9 ^f	n.a.	n.a.	n.a.	n.a.
Indonesia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Italy	36,477	6.8	37,438	6.6	133,686 ^g	24.5 ^g	n.a.	n.a.	n.a.	n.a.
Japan	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Netherlands	71.3	45.3	67.5	41.8	65.6	41.1	n.a.	n.a.	n.a.	n.a.
Norway	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Spain	n.a.	n.a.	n.a.	n.a.	1,652	23.5	n.a.	n.a.	n.a.	n.a.
Sweden	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Switzerland	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Taiwan	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	2.2	1.4	3.4	2.3	3.8	3.1	n.a.	n.a.	n.a.	n.a.

See next page for footnotes.

Table 26. Continued

^aBased on information from Office des publications officielles des Communautés européennes, Öffentliche aufwendungen für forschung und entwicklung 1980-1990/Government Financing of Research and Development 1980-1990/Le financement public de la recherche et du développement 1980-1990, Luxembourg, 1991, 74-75.

^bBased on information from Office des publications officielles des Communautés européennes, Öffentliche aufwendungen für forschung und entwicklung 1980-1991/Government Financing of Research and Development 1980-1991/Le financement public de la recherche et du développement 1980-1991, Luxembourg, 1992, 160-61.

^cBased on information from Office des publications officielles des Communautés européennes, Forschung und entwicklung: jährliche statistiken 1993/Research and Development: Annual Statistics 1993/Recherche et développement: statistiques annuelles 1993, Luxembourg, 1993, 142-43.

^dBased on information from Office des publications officielles des Communautés européennes, Öffentliche aufwendungen für forschung und entwicklung 1980-1990/Government Financing of Research and Development 1980-1990/Le financement public de la recherche et du développement 1980-1990, Luxembourg, 1991, 86-87.

^eBased on information from Office des publications officielles des Communautés européennes, Öffentliche aufwendungen für forschung und entwicklung 1980-1991/Government Financing of Research and Development 1980-1991/Le financement public de la recherche et du développement 1980-1991, Luxembourg, 1992, 172-73.

^fIncludes the new *Länder*.

^gFigure as given in the original.

**TABLE 27. GOVERNMENT-FINANCED MISCELLANEOUS RESEARCH ON PRODUCTION, DISTRIBUTION, AND
RATIONAL UTILIZATION OF ENERGY, 1989-93**
(In millions of the national currency and percentage of total energy R&D)

Country	1989		1990		1991		1992		1993	
	Funds ^a	% ^d	Funds ^b	% ^e	Funds ^c	% ^c	Funds	%	Funds	%
Australia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
France	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Germany	2.5	0.2	2.7	0.2	2.8 ^f	0.2 ^f	n.a.	n.a.	n.a.	n.a.
Indonesia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Italy	75,602	14.1	80,117	14.1	59,479	10.9	n.a.	n.a.	n.a.	n.a.
Japan	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Netherlands	2.2	1.4	2.6	1.6	2.5	1.6	n.a.	n.a.	n.a.	n.a.
Norway	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Spain	n.a.	n.a.	n.a.	n.a.	909	12.9	n.a.	n.a.	n.a.	n.a.
Sweden	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Switzerland	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Taiwan	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	8.3	5.2	9.3	6.2	0	0	n.a.	n.a.	n.a.	n.a.

See next page for footnotes.

Table 27. Continued

- ^aBased on information from Office des publications officielles des Communautés européennes, Öffentliche aufwendungen für forschung und entwicklung 1980-1990/Government Financing of Research and Development 1980-1990/Le financement public de la recherche et du développement 1980-1990, Luxembourg: 1991, 74-75.
- ^bBased on information from Office des publications officielles des Communautés européennes, Öffentliche aufwendungen für forschung und entwicklung 1980-1991/Government Financing of Research and Development 1980-1991/Le financement public de la recherche et du développement 1980-1991, Luxembourg: 1992, 160-61.
- ^cBased on information from Office des publications officielles des Communautés européennes, Forschung und entwicklung: jährliche statistiken 1993/Research and Development: Annual Statistics 1993/Recherche et développement: statistiques annuelles 1993, Luxembourg: 1993, 142-43.
- ^dBased on information from Office des publications officielles des Communautés européennes, Öffentliche aufwendungen für forschung und entwicklung 1980-1990/Government Financing of Research and Development 1980-1990/Le financement public de la recherche et du développement 1980-1990, Luxembourg: 1991, 86-87.
- ^eBased on information from Office des publications officielles des Communautés européennes, Öffentliche aufwendungen für forschung und entwicklung 1980-1991/Government Financing of Research and Development 1980-1991/Le financement public de la recherche et du développement 1980-1991, Luxembourg: 1992, 172-73.

^fIncludes the new *Länder*.

INDIVIDUAL COUNTRIES

AUSTRALIA

TABLE 28. AUSTRALIA: ENERGY R&D BY SECTOR AND SOURCE OF FUNDS, 1988-89
 (In thousands of Australian dollars)

Energy Sector	Total*	Business Enterprises		General Government		Higher Education		Private Non-profit	Source of funds*			
		Private Sector	Public Sector	Commonwealth	State	Universities	CAEs		Industry ^b	Government ^c		
PRODUCTION AND UTILIZATION OF ENERGY												
Oil and Gas												
Mining extraction techniques	1,144	n.a.	n.a.	0	155	828	162	0	124	1,020		
Refining, transport, and storage	4,246	n.a.	n.a.	3,172	0	879	195	0	570	3,676		
Other	15,728	n.a.	n.a.	11,693	1,409	2,173	319	135	348	15,380		
Oil shale and tar sands	3,946	n.a.	n.a.	3,172	0	761	14	0	505	3,441		
TOTAL OIL AND GAS	25,064	n.a.	n.a.	18,036	1,563	4,640	689	135	1,546	23,518		
Coal												
Mining extraction techniques	4,844	n.a.	n.a.	2,845	222	1,657	120	0	527	4,316		
Preparation and transport	6,358	n.a.	n.a.	3,448	1,793	965	152	0	771	5,587		
Combustion	3,456	n.a.	n.a.	1,400	45	1,817	195	0	306	3,150		
Conversion	811	n.a.	n.a.	0	0	789	21	0	60	751		
Other	7,083	n.a.	n.a.	2,811	2,045	2,047	179	0	575	6,508		
TOTAL COAL	22,551	n.a.	n.a.	10,504	4,105	7,275	668	0	2,240	20,312		

Energy Sector	Total ^a	Business Enterprises		General Government		Higher Education		Private Non-profit	Industry ^b	Source of funds ^c Government ^c
		Private Sector	Public Sector	Commonwealth	State	Universities	CAEs			
Solar Energy										
Heating and cooling	2,053	n.a.	n.a.	0	185	1,862	6	0	82	1,971
Photoelectric	2,452	n.a.	n.a.	0	55	2,373	24	1	201	2,251
Thermal-electric	453	n.a.	n.a.	0	0	420	33	1	6	447
TOTAL SOLAR	4,958	n.a.	n.a.	0	240	4,655	62	1	289	4,669
Nuclear										
TOTAL NUCLEAR	22,573	n.a.	n.a.	18,060	402	4,079	28	3	275	22,298
Other Primary Sources										
Wind	434	n.a.	n.a.	0	84	310	39	1	8	426
Ocean	0	n.a.	n.a.	0	0	0	0	0	0	0
Geothermal	0	n.a.	n.a.	0	0	0	0	0	0	0
Biomass	495	n.a.	n.a.	0	0	489	6	0	25	470
Other sources and new vectors	297	n.a.	n.a.	0	0	189	108	0	44	253
TOTAL OTHER PRIMARY SOURCES	1,226	n.a.	n.a.	0	84	989	153	1	76	1,150
TOTAL PRODUCTION AND UTILIZATION OF ENERGY	76,374	n.a.	n.a.	46,600	6,394	21,638	1,601	140	4,427	71,947
CONSERVATION OF ENERGY										
TOTAL CONSERVATION OF ENERGY	7,232	n.a.	n.a.	48	1,306	4,637	1,092	148	669	6,563

Energy Sector	Total ^a	Business Enterprises		General Government		Higher Education		Private Non-profit	Industry ^b	Source of funds ^c
		Private Sector	Public Sector	Commonwealth	State	Universities	CAEs			
OTHER ENERGY R&D										
Electric power conversion	2,494	n.a.	n.a.	391	0	2,053	50	0	367	2,127
Electricity transmission and distribution	3,217	n.a.	n.a.	0	0	2,824	393	0	192	3,025
Energy storage n.e.c.	7,378	n.a.	n.a.	6,554	0	818	6	0	1,006	6,372
Energy systems analysis	1,510	n.a.	n.a.	243	304	950	13	0	36	1,475
Other	244	n.a.	n.a.	0	0	244	0	0	10	234
TOTAL OTHER ENERGY R&D	14,843	n.a.	n.a.	7,189	304	6,889	462	0	1,610	13,233
TOTAL	98,449	n.a.	n.a.	53,837	8,004	33,164	3,155	288	6,707	91,742

^aExcludes business enterprise sector.

^bExcludes private non-profit organizations.

^cIncludes commonwealth and state government organizations, universities, and colleges of advanced education.

Source: Based on information from Australian Bureau of Statistics, Research and Experimental Development: All-Sector Summary: Australia, 1988-89, (Catalogue No. 8112.0), Canberra, n.d., 20-21.

TABLE 29. AUSTRALIA: ENERGY R&D EXPENDITURES BY BUSINESS ENTERPRISES^a, BY INDUSTRY, 1988-89 AND 1990-91
(In thousands of Australian dollars)

Industry	1988-89			1990-91		
	Total Expenditures	Source of Funds		Total Expenditure	Source of Funds	
		Industry ^b	Government ^c		Industry ^b	Government ^c
Total Mining (excluding services to mining)	15,336	14,462	874	9,419	n.p.^d	n.p.
Manufacturing						
Food, beverages, and tobacco	120	120	0	n.p.	n.p.	0
Textiles, clothing, and footwear	341	n.p.	n.p.	n.p.	n.p.	0
Wood, wood products, and furniture	n.p.	n.p.	0	n.p.	n.p.	0
Paper, paper products, printing, and publishing	n.p.	0	n.p.	n.p.	n.p.	0
Chemical, petroleum, and coal products	771	n.p.	n.p.	805	805	0
Non-metallic mineral products	246	246	0	509	509	0
Basic metal products	n.p.	n.p.	n.p.	6,371	n.p.	n.p.
Fabricated metal products	1,162	1,162	0	288	288	0
Transport equipment	445	445	0	1,550	n.p.	n.p.
Photographic, professional, and scientific equipment	n.p.	n.p.	0	n.p.	n.p.	0
Appliances and electrical equipment	8,060	7,518	542	9,974	8,896	1,078
Industrial machinery and equipment	2,716	2,526	190	1,820	n.p.	n.p.
Miscellaneous manufacturing	973	n.p.	n.p.	319	n.p.	n.p.
Total manufacturing	21,580	19,254	2,326	23,574	20,813	2,761
Other industries						
Wholesale and retail trade	1,647	n.p.	n.p.	3,170	2,613	557

Industry	1988-89			1990-91		
	Total Expenditures	Source of Funds		Total Expenditure	Source of Funds	
		Industry ^b	Government ^c		Industry ^b	Government ^c
Finance	n.p.	n.p.	n.p.	n.p.	n.p.	0
Property and business services	22,381	19,848	2,532	37,462	33,659	3,802
Research and scientific institutions	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.
Other	29,048	27,274	1,774	27,927	25,775	2,152
Total other industries	67,214	58,065	9,149	82,339	n.p.	n.p.
TOTAL ALL INDUSTRIES	104,130	91,781	12,350	115,332	101,683	13,649
Private sector contribution	83,440	72,652	10,789	94,103	82,167	11,936
Public sector contribution	20,690	19,129	1,561	21,229	19,516	1,713

^aExcludes enterprises in ASIC Division 'A'.

^bIncludes private and public business enterprises and private non-profit organizations.

^cIncludes commonwealth and state government organizations, universities, and colleges of advanced education.

^dN.p. = Not available for separate publication (but included in totals where applicable).

Source: Based on information from Australian Bureau of Statistics, Research and Experimental Development: Business Enterprises: Australia, 1990-91, (Catalogue No. 8104.0), Canberra, n.d., 16

TABLE 30. AUSTRALIA: R&D EXPENDITURES BY GENERAL GOVERNMENT ORGANIZATIONS, 1990-91
 (In thousands of Australian dollars)

Socio-Economic Objective	Type of Expenditure			Total	
	Land and Buildings	Other Capital Expenditures	Labor Costs		
Energy	1,017	3,915	18,025	9,322	32,279

Source: Based on information from Australian Bureau of Statistics, Year Book Australia, Canberra, 1994, 681.

TABLE 31. AUSTRALIA: HUMAN RESOURCES DEVOTED TO R&D BY GENERAL GOVERNMENT ORGANIZATIONS, 1990-91
(In person years)

Socio-Economic Objective	Type of Employee			Total
	Researchers	Technicians	Other Supporting Staff	
Energy	164	87	65	316

Source: Based on information from Australian Bureau of Statistics, Year Book Australia, Canberra, 1994, 682.

TABLE 32. AUSTRALIA: R&D EXPENDITURES BY NON-PROFIT ORGANIZATIONS, 1990-91
(In thousands of Australian dollars)

Socio-Economic Objective	Type of Expenditure			Total
	Land and Buildings	Other Capital Expenditures	Labor Costs	
Energy	0	9	110	146
				265

Source: Based on information from Australian Bureau of Statistics, Year Book Australia, Canberra, 1994, 684.

TABLE 33. AUSTRALIA: HUMAN RESOURCES DEVOTED TO R&D BY PRIVATE NON-PROFIT ORGANIZATIONS, 1990-91
(In person years)

Socio-Economic Objective	Type of Employee			Total
	Researchers	Technicians	Other Supporting Staff	
Energy	2	0	0	2

Source: Based on information from Australian Bureau of Statistics, Year Book Australia, Canberra, 1994, 685.

TABLE 34. AUSTRALIA: MAJOR R&D GRANT PROGRAMS AND OTHER SUPPORT FOR SCIENCE AND INNOVATION
 THROUGH THE BUDGET, 1990-91
 (In millions of Australian dollars and percentage of total)

	Outlays						Estimated			
	1989-90		1990-91		1991-92		1992-93		1993-94	
	\$	%	\$	%	\$	%	\$	%	\$	%
Energy research	11.2	3.4	15.9	5.1	11.8	2.9	11.6	2.4	10.9	2.1
										11.1
										1.9

Source: Based on information from Australia, Commonwealth Information Services, *Science and Technology Budget Statement, 1994-95*, Canberra, 1994, 42.

FRANCE

TABLE 35. FRANCE: DOMESTIC EXPENDITURES FOR ENERGY R&D, 1989-91
(In millions of French francs)

	1989	1990	1991
Energy R&D	2,964	2,893	2,990

Source: Based on information from France, Ministère de l'Enseignement supérieur et de la Recherche.

GERMANY

TABLE 36. GERMANY: FEDERAL EXPENDITURES FOR ENERGY R&D, 1989-93
(In millions of Deutsche marks)^a

Energy source	1989	1990	1991	1992	1993
	Actual				
Coal and other fossil fuels	157.2	153.0	113.1	96.8	88.2
Renewable energy and energy conservation	239.6	289.4	330.8	371.5	368.3
Nuclear energy (excluding decommissioning of nuclear facilities)	640.2	632.9	505.5	421.0	381.7
Decommissioning of nuclear facilities; risk sharing	0	0	75.1	23.2	33.1
Nuclear fusion	188.8	192.5	197.6	232.1	234.1
TOTAL EXPENDITURES	1,225.7	1,267.9	1,222.1	1,144.6	1,105.4

Source: Based on information from Germany, Federal Ministry for Research and Technology, "Federal R&D Expenditure on 'Energy Research and Energy Technology' Broken Down by Promotion Priorities, 1989-1993." (Fax transmission from Dr. Erika Rost.)

^aThese figures include block grants for national research centers (Großforschungseinrichtungen), but do not include block grants to the Max Planck Society (MPG) or to the Fraunhofer Society (FhG).

TABLE 37. GERMANY: RENEWABLE ENERGY IN THE "3RD PROGRAM FOR ENERGY RESEARCH AND ENERGY TECHNOLOGIES" OF THE GERMAN FEDERAL GOVERNMENT, 1989-92
 (In millions of Deutsche marks)

Type of Renewable Energy	1989	1990	1991	1992*
Photovoltaics	82.5	91.9	104.0	94.9
Wind energy - project funding	12.4	18.1	9.8	12.0
Wind energy - indirect specific funding	0.2	3.8	7.8	13.5
Applications systems for southern climatic conditions	32.5	34.1	42.4	38.0
Biological energy gain, storage, and use	1.3	8.5	16.0	39.4
Geothermal energy and other	10.9	14.3	16.7	17.0
Secondary energy systems	9.7	10.3	7.7	9.0
Energy-saving industrial processes	12.6	12.2	17.1	15.0
Energy storage	10.2	11.2	9.1	11.0
Hydrogen	15.7	18.1	23.2	33.5
Rational energy use and solar energy use in households and low-power consumers	21.3	22.1	22.2	30.0
Total, excluding large research facilities	209.4	244.5	276.0	313.3
Large research facilities	30.2	32.6	33.8	35.6
TOTAL FUNDING	239.6	277.1	309.8	348.9

*Planned.

Source: Based on information from Germany, Federal Minister for Research and Technology, Renewable Energy: Status, Outlook, Research Goals, Bonn, 1992, 13.

INDONESIA

TABLE 38. INDONESIA: INVESTMENTS IN GEOTHERMAL PROJECTS IN REPELITA V^a
(In millions of U.S. dollars)

Projects	Total
Exploration of geothermal sources	34.5
Geothermal steam development	42.3
Total	76.8

^aREPELITA V covers the years 1989/90 to 1994/95.

Source: Based on information from Indonesia, Nation Energy Coordinating Board (BAKOREN), National Energy Policy, (translation of Kebijaksanaan Umum Bidang Energi), Jakarta, 1992, 72.

TABLE 39. INDONESIA: INVESTMENTS IN NEW AND RENEWABLE ENERGY SOURCE DEVELOPMENT PROJECTS
IN REPELITA V*
 (In trillions of rupiahs)

Projects	Funds
Survey, inventory, and guidance of new energy	0.54
New energy development and utilization	2.47
Energy conservation	0.60
Rural energy	4.50
TOTAL	8.11

*REPELITA V covers the years 1989/90 to 1994/95.

Source: Based on information from Indonesia, Nation Energy Coordinating Board (BAKOREN), National Energy Policy, (translation of Kebijaksanaan Umum Bidang Energi), Jakarta, 1992, 75.

TABLE 40. INDONESIA: INVESTMENTS IN BIOMASS ENERGY DEVELOPMENT PROJECTS IN REPELITA V*
(In trillions of rupiahs)

Projects	Funds
Energy plantation development	0.80
Wood utilization	0.88
Wood waste utilization	1.00
Research and development of wood gas	0.52
Alcohol development	0.48
Sago tree development	0.32
TOTAL	4.00

*REPELITA V covers the years 1989/90 to 1994/95.

Source: Based on information from Indonesia, Nation Energy Coordinating Board (BAKOREN), National Energy Policy, (translation of Kebijaksanaan Umum Bidang Energi), Jakarta, 1992, 75.

ITALY

TABLE 41. ITALY: ENI^a R&D EXPENDITURES, 1989-93
(In millions of Italian lira)

		TECHNOLOGY AREA	1989	1990	1991	1992	1993
GROUP I CONSERVATION	Industry	300	1704	925	0	0	0
	Residential and Commercial	700	593	925	0	0	0
	Transportation	0	0	0	0	0	0
	Others	300	0	0	0	0	0
	TOTAL GROUP I	1300	2297	1850	0	0	0
GROUP II OIL AND GAS COAL AND NUCLEAR (non-breeder)	Enhanced oil and gas	4,751	3,500	3,000	16,827	16,307	
	Refining, transportation, and storage	54,900	58,309	98,251	99,316	105,495	
	Oil shale and tar sands	0	0	0	0	0	
	Others	77,354	109,050	68,209	100,831	137,657	
	Total 2--Oil and gas	137,005	170,859	169,460	216,974	259,459	
GROUP II OIL AND GAS COAL AND NUCLEAR (non-breeder)	Production, preparation, and	8,106	12,684	3,849	2,567	3,123	
	Combustion	15,539	24,127	11,062	0	0	
	Conversion	3,821	1,582	2,054	2,694	4,319	
	Others	0	0	0	0	0	
	Total 3--Coal	27,466	38,393	16,965	7,261	7,442	
Total 4--Nuclear		0	0	0	0	0	
TOTAL GROUP II		164,471	209,252	186,425	224,235	286,901	

		TECHNOLOGY AREA	1989	1990	1991	1992	1993
GROUP III NEW ENERGY SOURCES	Heating and Cooling	600	600	0	0	0	0
	Photoelectric	2,250	7,216	2,976	4,028	4,500	
	Thermal electric	0	0	0	0	0	
	Total 5--Solar	2,850	7,816	2,976	4,028	4,500	
GROUP III NEW ENERGY SOURCES	Wind	0	0	0	0	0	0
	Ocean	0	0	0	0	0	0
	Biomass	6,398	4,910	1,958	1,995	3,270	
	Geothermal energy	0	0	0	0	0	
TOTAL GROUP III		9,248	12,726	4,934	6,023	7,776	
GROUP IV ADVANCED NUCLEAR	TOTAL GROUP IV	0	0	0	0	0	0
GROUP V POWER AND STORAGE TECHNOLOGIES							
GROUP V POWER AND STORAGE TECHNOLOGIES	Electric power conversion	10,865	11,144	13,162	16,116	19,473	
	Electricity, transmission, and	0	0	0	0	0	
	Energy storage	0	0	0	0	45	
TOTAL GROUP V		10,865	11,144	13,162	16,116	19,518	

		TECHNOLOGY AREA			1990		1991		1992		1993	
GROUP VI SUPPORTING TECHNOLOGIES	Energy system analysis	0	0	0	0	0	0	3,733	3,733	1,039	1,039	
	Others	0	0	0	0	0	0	0	0	0	0	
TOTAL GROUP VI		0	0	0	0	0	0	3,733	3,733	1,039	1,039	
TOTAL R&D EXPENDITURE		185,884	235,419	206,371	250,107	250,107	250,107	295,234	295,234	295,234	295,234	

*ENI (Ente Nazionale Idrocarburi) is the Italian government's oil and gas conglomerate.

Source: Based on information from Italy, Ente Nazionale Idrocarburi (ENI). (Fax transmission from Franco Morisi.)

JAPAN

TABLE 42. JAPAN: BUDGETS FOR ENERGY R&D, BY SUBCOMPONENT, 1989-92
(In millions of yen)^a

Energy Source	1989 ^b	1990 ^c	1991 ^d	1992 ^e
Fossil Fuels				
Oil	42,685	43,313	54,423	45,684
Gas	5,600	6,348	6,929	7,216
Coal	24,797	36,389	29,210	35,136
Other	3,402	3,888	5,417	6,329
TOTAL FOSSIL FUELS	76,484	89,939	95,977	94,365
Renewable Sources				
Geothermal	4,171	3,701	3,807	4,028
Solar	14,870	15,906	19,821	21,963
Ocean	847	744	1,073	1,274
Wind	1,513	1,267	1,719	1,490
Biomass	5,629	5,902	4,746	4,862
Other	899	691	1,518	1,906
TOTAL RENEWABLE SOURCES	27,929	28,210	32,681	35,544

Energy Source	1989 ^b	1990 ^c	1991 ^d	1992 ^e
Conservation				
Industrial	67,892	46,286	43,515	41,335
Residential	29,940	31,215	35,678	40,717
Transport	230,336	243,775	254,636	254,416
Conversion & storage of electricity	35,664	31,873	39,400	53,987
Hydrogen	7,627	6,823	6,550	7,381
Other	6,660	10,002	14,554	12,880
TOTAL CONSERVATION	352,556	369,974	394,332	420,778
Nuclear Energy	425,957	401,974	435,835	488,017
Other Energy	23,291	23,873	15,670	17,756
TOTAL ENERGY R&D BUDGET	906,216	913,970	974,499	1,046,457

^aTotals reflect figures given in sources.

^bBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1991, 36.

^cBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1992, 36.

^dBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1993, 36.

^eBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1994, 36.

TABLE 43. JAPAN: EXPENDITURES FOR ENERGY R&D BY INDUSTRY, 1989-92
(In millions of yen)^a

Energy Source	1989 ^b	1990 ^c	1991 ^d	1992 ^e
Fossil Fuels				
Oil	23,428	23,430	31,511	22,383
Gas	5,062	5,987	6,707	6,634
Coal	14,618	17,159	14,908	17,545
Other	3,112	3,323	4,257	5,070
TOTAL FOSSIL FUELS	46,241	49,899	57,383	52,067
Renewable Sources				
Geothermal	1,467	923	829	1,064
Solar	11,189	10,925	11,526	12,398
Marine	264	246	349	510
Wind	937	785	1,244	956
Biomass	1,357	1,494	1,688	1,521
Other	422	168	332	439
TOTAL RENEWABLE SOURCES	15,636	14,541	15,968	16,888

Energy Source	1989 ^b	1990 ^c	1991 ^d	1992 ^e
Conservation				
Industrial	35,594	39,638	38,220	36,374
Residential	28,262	29,692	33,691	37,945
Transport	80,185	80,254	94,215	93,802
Conversion & storage of electricity	27,355	26,570	31,784	42,685
Hydrogen	6,284	5,427	5,121	5,348
Other	3,935	6,618	10,436	7,724
TOTAL CONSERVATION	181,614	188,198	213,466	233,878
Nuclear Energy	76,492	82,669	71,321	77,127
Other Energy	12,409	13,566	9,503	11,048
TOTAL ENERGY R&D BUDGET	332,392	349,173	367,641	381,027

^aBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1991, 36.

^bBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1992, 36.

^cBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1993, 36.

^dBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1994, 36.

TABLE 44. JAPAN: EXPENDITURES FOR ENERGY R&D BY GOVERNMENT RESEARCH INSTITUTES, 1989-92
(In millions of yen)^a

Energy Source	1989 ^b	1990 ^c	1991 ^d	1992 ^e
Fossil Fuels				
Oil	147	129	171	77
Gas	46	34	1	92
Coal	1,592	1,489	1,162	1,230
Other	68	0	0	2
TOTAL FOSSIL FUELS	1,853	1,653	1,334	1,401
Renewable Sources				
Geothermal	1,400	1,419	1,476	1,333
Solar	1,005	1,119	1,109	1,075
Marine	204	177	203	200
Wind	195	225	224	230
Biomass	1,179	1,023	974	1,058
Other	53	43	17	34
TOTAL RENEWABLE SOURCES	4,035	4,004	4,002	3,931

Energy Source	1989 ^b	1990 ^c	1991 ^d	1992 ^e
Conservation				
Industrial	1,931	1,804	1,665	1,760
Residential	260	244	224	250
Transport	955	826	695	446
Conversion & storage of electricity	4,277	975	1,023	1,588
Hydrogen	338	300	274	361
Other	149	219	234	252
TOTAL CONSERVATION	7,910	4,369	4,116	4,657
Nuclear Energy	281,957	250,991	295,425	332,676
Other Energy	687	679	510	594
TOTAL ENERGY R&D BUDGET	296,442	261,696	305,389	343,257

^aTotals reflect figures given in sources.

^bBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1991, 36.

^cBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1992, 36.

^dBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1993, 36.

^eBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1994, 36.

TABLE 45. JAPAN: EXPENDITURES FOR ENERGY R&D BY UNIVERSITIES AND COLLEGES, 1989-92
(In millions of yen)^a

Energy Source	1989 ^b	1990 ^c	1991 ^d	1992 ^e
Fossil Fuels				
Oil	469	687	625	665
Gas	225	268	195	352
Coal	931	846	910	948
Other	179	156	171	150
TOTAL FOSSIL FUELS	1,623	1,957	1,900	2,115
Renewable Sources				
Geothermal	446	462	504	487
Solar	1,586	1,849	1,922	2,782
Marine	347	287	456	535
Wind	381	257	251	304
Biomass	1,610	1,998	1,876	1,853
Other	211	272	214	373
TOTAL RENEWABLE SOURCES	4,581	5,125	5,223	6,345

Energy Source	1989 ^b	1990 ^c	1991 ^d	1992 ^e
Conservation				
Industrial	1,942	1,782	1,552	1,909
Residential	729	885	757	928
Transport	881	968	915	1,072
Conversion & storage of electricity	1,610	1,376	1,504	1,451
Hydrogen	875	985	906	1,346
Other	516	576	481	740
TOTAL CONSERVATION	6,554	6,575	6,115	7,447
Nuclear Energy	24,255	27,185	28,834	32,639
Other Energy	567	799	646	660
TOTAL ENERGY R&D BUDGET	37,780	41,640	42,719	49,206

^aTotals reflect figures given in sources.

^bBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1991, 36.

^cBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1992, 36.

^dBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1993, 36.

^eBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1994, 36.

TABLE 46. JAPAN: EXPENDITURES FOR ENERGY R&D BY PRIVATE RESEARCH INSTITUTES, 1989-92
(In millions of yen)^a

Energy Source	1989 ^a	1990 ^b	1991 ^c	1992 ^d
Fossil Fuels				
Oil	18,621	19,067	22,116	22,104
Gas	247	59	26	138
Coal	7,656	16,895	12,230	15,413
Other	43	409	989	1,107
TOTAL FOSSIL FUELS	26,567	36,430	35,360	38,762
Renewable Sources				
Geothermal	858	897	998	1,133
Solar	1,090	2,013	5,264	5,708
Marine	32	34	65	29
Wind	0	0	0	0
Biomass	1,483	1,387	206	450
Other	213	208	955	1,060
TOTAL RENEWABLE SOURCES	3,677	4,540	7,488	8,380

Energy Source	1989 ^a	1990 ^b	1991 ^c	1992 ^d
Conservation				
Industrial	28,425	3,059	2,078	1,292
Residential	689	394	1,006	1,594
Transport	148,315	161,727	158,811	159,156
Conversion & storage of electricity	2,422	2,952	5,089	8,263
Hydrogen	130	111	249	326
Other	2,080	2,560	3,403	4,164
TOTAL CONSERVATION	156,478	170,832	170,635	174,796
Nuclear Energy	43,253	41,129	40,255	45,575
Other Energy	9,528	8,531	5,011	5,454
TOTAL ENERGY R&D BUDGET	239,602	261,461	258,750	272,967

^aTotals reflect figures given in sources.

^bBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1991, 36.

^cBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1992, 36.

^dBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1993, 36.

^eBased on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1994, 36.

TABLE 47. JAPAN: GOVERNMENT BUDGET FOR ENERGY R&D, 1989-93
(In millions of yen)

Source of Funding	FY1989	FY1990	FY1991	FY1992	FY1993
Agency of Science and Technology	281,786	296,351	306,594	254,791	256,023
Environment Agency	30	23	0	290	278
Ministry of Foreign Affairs	3,204	3,541	4,451	4,463	5,148
Ministry of Education	16,326	15,446	13,816	15,948	17,815
Ministry of Agriculture, Forestry, and Fisheries	479	443	438	585	651
Ministry of International Trade and Industry	52,421	51,998	41,615	79,834	84,609
Ministry of Transportation	33	28	34	55	93
Ministry of Construction	11	15	9	179	250
Ministry of Welfare	0	0	0	47	58
Agency of Hokkaido Development	0	0	0	2	4
TOTAL	354,289	367,845	366,957	356,194	364,930

Source: Based on information from Japan, Science and Technology Agency, Science and Technology Policy Bureau, Indicators of Science and Technology, Tokyo, 1994, 140.

TABLE 48. JAPAN: BUDGET FOR "NEW SUNSHINE" PROJECT^a, FY1992 AND FY1993
(In millions of yen)

Areas of Research	FY1992 Budget	FY1993 Budget
Renewable energy	12,920	13,289
Solar-energy technology	6,989	7,660
Geothermal energy technology	4,906	4,606
Wind-power energy technology	982	979
Ocean-energy technology	17	17
Bio-energy technology	25	27
Advanced utilization of fossil fuels	19,746	21,471
Coal liquefaction and gasification technology	13,282	14,101
Technology for generating electricity from fuel cells	4,332	5,039
Ceramic gas turbines	2,132	2,331
Energy transport and storage	5,165	4,724
Technology for applying superconducted electric power	3,172	3,993
Distributed-cell electric power storage battery	336	791
Super-heat-pump energy accumulation system	1,118	0
Technology for environmental measures	230	267
Lean-burning-combustion engine exhaust gas denitration catalyst	0	29
Global environmental technology	230	238

Areas of Research	FY1992 Budget	FY1993 Budget
Systemization technology	220	1,021
Wide-area energy usage network system	0	610
Technology for international hydrogen usage clean energy system	120	412
Basic, key energy/environmental technologies	100	100
Other	11,975	13,028
TOTAL	50,255	53,901

*In late 1992, MITI consolidated its conservation, renewables and environment technology programs in the New Sunshine Project.

Source: Based on information from "Fiscal Year 1993 Budgets for Science and Technology: Ministry of International Trade and Industry," Gakujutsu Geppo [Tokyo] July 1993. Joint Publication Research Service, JPRS Report: Science and Technology: Japan. (JPRS-JST-94-001.) January 24, 1994, 79.

NETHERLANDS

TABLE 49. NETHERLANDS: GOVERNMENT FINANCING OF ENERGY R&D, 1991-97
(In millions of guilders)

Area of Research	Actual Expenditure 1991	Preliminary Estimate 1992	Projected Estimate 1993	Estimates for Several Years			
				1994	1995	1996	1997
Production, Distribution, and Rational Utilization of Energy (Total)	162.8	155.2	154.9	158.2	161.9	168.2	168.9
General Research	68.5	65.9	67.4	71.4	75.1	78.9	82.5
Fossil Fuels and Derivatives	18.6	17.2	17.0	17.0	17.0	17.0	17.0
Fission	49.4	46.7	45.5	44.9	44.9	47.9	44.9
Fusion	8.1	7.5	7.0	7.0	7.6	7.6	7.6
New Energy Sources	5.9	5.5	5.2	5.2	5.1	5.1	5.1
Rational Use of Energy	9.8	10.1	9.8	9.8	9.8	9.3	9.3
Other Research	2.5	2.3	2.3	2.3	2.3	2.3	2.3

Source: Based on information from Netherlands, Minister van Onderwijs en Wetenschappen, Wetenschapsbudget 1993, 's-Gravenhage, 1992, 149.

TABLE 50. NETHERLANDS: GOVERNMENT EXPENDITURE FOR ENERGY R&D, BY TYPE OF INSTITUTE, 1991
(In millions of guilders)

	Government Institutes	Semi-Government Institutes (Excl. TNO)	TNO*	Mainly Serving Business Enterprises	Institutes Affiliated with Universities	Other Institutions	Total
Energy	0	114	29	3	0	2	148
General Research	0	9	-	2	0	1	12
Coal	-	15	2	1	-	-	18
Petroleum and Natural Gas	0	1	-	0	-	-	1
Nuclear Energy	-	57	-	-	-	-	57
Wind Energy	-	9	-	-	-	1	10
Solar Energy	-	-	-	-	-	-	-
Other Energy Research	0	23	27	-	-	-	50

*TNO = Netherlands Organization for Applied Scientific Research.

Source: Based on information from Netherlands, Minister van Onderwijs en Wetenschappen, Wetenschapsbudget 1993, 's-Gravenhage, 1992, 63.

NORWAY

TABLE 51. NORWAY: BUDGETS FOR ENERGY R&D, 1989-94
(In millions of Norwegian krone)

ENERGY SOURCE	1989	1990	1991	1992	1993	1994 ^a
Energy Conservation	74.5	63.2	82.9	92.4	90.0	51.8
Oil and Gas	151.1	122.1	106.9	111.6	100.1	158.2
Coal	0.7	0.6	0.7	0.6	0.7	0.0
Nuclear (Conventional)	20.7	18.2	18.8	52.1	53.3	50.4
Renewable Energy Sources ^b	22.1	33.8	39.5	45.9	33.1	24.5
Solar	5.2	9.5	10.5	14.6	12.7	7.0
Wind	5.7	9.3	12.0	12.0	4.3	2.4
Ocean	1.6	3.8	5.5	5.4	3.0	2.2
Biomass	7.9	11.9	11.5	13.7	13.2	13.0
Electricity	26.9	30.7	29.2	18.6	18.7	18.2
Energy Systems and Analysis	58.0	48.8	61.6	47.7	47.5	30.8
Hydroelectric Power	0	0	0	23.6	23.0	21.7

^aEstimated.

^bTotals reflect figures given in sources.

Source: Based on information from Norway, Ministry of Industry and Energy. Figures are based on the average yearly exchange rate between the U.S. dollar and the Norwegian krone.

SPAIN

TABLE 52. SPAIN: ENERGY RESEARCH PLAN: 1989-1992^a
(In millions of Spanish pesetas)

Sector	Annual National Budget	OCIs ^b	Private Companies	Total	Percentage by Sector
Coal	1,220	1,400	1,440	4,060	7%
Electricity	18,211	15,800	6,154	40,165	64%
Gas	0	900	301	1,201	2%
Nuclear	4,984	0	5,110	10,094	16%
Oil	0	5,200	1,730	6,930	11%
TOTAL	24,415	23,300	14,735	62,450	100%
PERCENTAGE OF TOTAL^c	39%	37%	24%	100%	-

^aAlthough figures are shown for 1989-1992, the plan remained in effect through 1993.

^bOficinas de Coordinación de la Investigación (Research Coordination Offices).

^cFigures rounded for technical reasons.

Source: Based on information from Spain, Ministry of Industry, Trade, and Tourism, Secretary General of Energy and Mineral Resources, National Energy Plan 1991-2000, Madrid, 174.

TABLE 53. SPAIN: ENERGY RESEARCH PLAN, BY SECTOR AND SUBCOMPONENT, 1989-1992*
 (In millions of Spanish pesetas)

Energy Source	Funding	Percentage of Sector Total
COAL		
Mining	3,320	81.8
Utilization	740	18.2
TOTAL COAL	4,060	100.0
ELECTRICITY		
Cost reduction	4,885	12.2
Quality of service	2,285	5.7
Cleaner burning	9,390	23.4
Availability and safety of nuclear		
New technologies	15,680	39.0
TOTAL ELECTRICITY	40,165	100.0
GAS		
Transmission and distribution	654	54.5
Utilization	440	36.6
Others	107	8.9
TOTAL GAS	1,201	100.0
NUCLEAR ENERGY		
TOTAL NUCLEAR ENERGY	10,094	100.0

Energy Source	Funding	Percentage of Sector Total
OIL		
Refining	4,160	60.0
Utilization of oil products	2,770	40.0
TOTAL OIL	6,930	100.0
TOTAL ENERGY R&D BUDGET	62,450	100.0

*Although figures are shown for 1989-1992, the plan remained in effect through 1993.

Source: Based on information from Spain, Ministry of Industry, Trade, and Tourism, Secretary General of Energy and Mineral Resources, National Energy Plan 1991-2000, Madrid, 196-78.

SWEDEN

TABLE 54. SWEDEN: ESTIMATED ENERGY AND WATER SUPPLY R&D FUNDS, BY MINISTRIES, 1993/94
(In millions of Swedish krona and percentage)*

Objective	Department of Labor	Commerce Department	Department of Agriculture	Department of the Environment and Natural Resources	Ministry of Foreign Affairs	Total	
	Funds	Funds	Funds	Funds	Funds	Funds	Percentage of Total R&D Funds
Energy and water supply	0	240	76	68	21	405	2

*Current prices.

Source: Based on information from Sweden, Statistiska Centralbyrån, Avdelningen för ekonomisk statistik, Forskning och informationsteknologi, Forskningsstatistik: Statliga anslag till forskning och utveckling budgetåret, 1993/94, Stockholm, 1994, 50.

TABLE 55. SWEDEN: ESTIMATED ENERGY AND WATER SUPPLY R&D FUNDS, 1989/90 TO 1993/94
(In millions of Swedish krona)^a

Objective	1989/90	1990/91	1991/92	1992/93	1993/94
Energy and water supply	538	564	510	441	405

^aCurrent prices.

Source: Based on information from Sweden, Statistiska Centralbyrån, Avdelningen för ekonomisk statistik, Forskning och informationsteknologi, Forskningsstatistik: Statiqa anslag till forskning och utveckling budgetåret, 1993/94, Stockholm, 1994, 51.

TABLE 56. SWEDEN: ESTIMATED ENERGY AND WATER SUPPLY R&D FUNDS, 1985 PRICES, 1989/90 TO
 1993/94
 (In millions of Swedish krona)^a

Objective	1989/90	1990/91	1991/92	1992/93	1993/94
Energy and water supply	420	657	338	288	258

^aCurrent prices.

Source: Based on information from Sweden, Statistiska Centralbryån, Avdelningen för ekonomisk statistik, Forskning och informationsteknologi, Forskningsstatistik: Statliga anslag till forskning och utveckling budgetåret, 1993/94, Stockholm, 1994, 52.

TABLE 57. SWEDEN: ESTIMATED ENERGY AND WATER SUPPLY R&D FUNDS, 1989/90 TO 1993/94
(In percentage of total R&D funds)^a

Objective	1989/90	1990/91	1991/92	1992/93	1993/94
Energy and water supply	3.7%	3.4%	2.8%	2.4%	2.2%

^aCurrent prices.

Source: Based on information from Sweden, Statistiska Centralbyrån, Avdelningen för ekonomisk statistik, Forskning och informationsteknologi, Forskningsstatistik: Statliga anslag till forskning och utveckling budgetåret, 1993/94, Stockholm, 1994, 54.

TABLE 58. SWEDEN: CHANGES IN GOVERNMENT ENERGY AND WATER SUPPLY R&D FUNDS, 1989/90 TO 1993/94

(In millions of Swedish krona and percentage)*

Objective	1989/90--1990/91	1990/91--1991/92	1991/92--1992/93	1992/93--1993/94
Energy and water supply	4.7%	-9.4%	-13.6%	-8.1%

*Current prices.

Source: Based on information from Sweden, Statistiska Centralbyrån, Avdelningen för ekonomisk statistik, Forskning och informationsteknologi, Forskningsstatistik: Statliga anslag till forskning och utveckling budgetåret, 1993/94, Stockholm, 1994, 55.

SWITZERLAND

TABLE 59. SWITZERLAND: EXPENDITURES OF PUBLIC ORGANIZATIONS (INCLUDING THE NATIONAL ENERGY RESEARCH FOUNDATION^a) ON ENERGY RESEARCH^b, 1990-93
(In millions of Swiss francs)

Area of Research ^c	1990	1991	1992	1993
1. Rational utilization of energy/heat recovery	24.4	29.0	33.4	36.4
1.1 Utilization of energy in industry and crafts	2.7	3.3	3.3	3.6
1.2 Utilization of energy in buildings	9.6	10.5	11.4	12.6
1.3 Utilization of energy in transportation	5.7	9.2	10.1	10.8
1.4 Heat recovery systems	6.4	6.0	8.6	9.4
2. Petroleum and gas	11.1	15.1	17.1	17.6
3. Coal	1.9	1.6	0.3	0.2
4. Solar energy	27.9	31.4	35.1	36.3
4.1 Solar heating	8.5	10.1	10.0	11.7
4.2 Photovoltaic	11.2	14.3	17.5	14.5
4.3 Regional heating and solar chemistry	8.2	7.0	7.6	10.1
5. Wind energy	0.7	0.5	0.1	0.2
7. Biomass	5.4	6.0	9.0	9.3
8. Geothermal energy	4.0	5.1	5.0	7.3
9. Hydroelectric	^d	^d	^d	^d
9.1 Large hydroelectric plants			3.3	3.1
9.2 Small hydroelectric plants			3.0	2.8
10. Nuclear fission	38.6	37.8	35.5	35.7
11. Nuclear fusion	35.0	32.5	32.0	32.2
12. Electricity production and energy storage	27.3	28.1	34.8	30.0
12.1 Electricity conversion (including fuel cells)	8.1	9.0	11.2	8.8
12.2 Electricity transmission and distribution	3.9	4.4	9.3	8.6
12.3 Energy storage (including hydrogen)	15.3	14.7	14.3	12.6

Area of Research ^c		1990	1991	1992	1993
13. General research		10.9	11.9	15.0	15.0
13.1 Socio-economic and systems analyses		9.7	9.9	13.1	13.3
13.2 Miscellaneous (including management)		1.2	2.0	1.9	1.7
TOTAL EXPENDITURES (Estimated accuracy)		187.2 (+/- 10)	199.0 (+/- 10)	220.6 (+/- 11)	223.3 (+/- 12)

^aFonds national pour la recherche énergétique.

^bArea of Research no.6 (Wave and Tidal Energy) is of no interest to Switzerland, and has been left out.

^cIEA (International Energy System) classification system.

^dThe total is included under heading 12.1.

Source: Based on information from Switzerland, L'Office fédéral de l'énergie, Recherche, développement et démonstration dans le domaine de l'énergie en Suisse: Liste des projets, 1992/1993, Berne, April 1994, 3.

TABLE 60. SWITZERLAND: SWISS ENERGY R&D CLASSIFICATION SYSTEM

Swiss System	Corresponding IEA* Classifications
I. Rational utilization of energy	1. Rational use of energy/heat recovery
II. Fossil fuels	2. Petroleum and gas 3. Coal
III. Nuclear fission	10. Nuclear fission
IV. Renewable sources of energy	4. Solar energy 5. Wind energy 7. Biomass 8. Geothermal energy 9. Hydroelectricity
V. Nuclear fusion	11. Nuclear fusion
VI. Support technologies	12. Electricity production and conversion, storage techniques (excluding heat storage) 13. General research

*International Energy Agency.

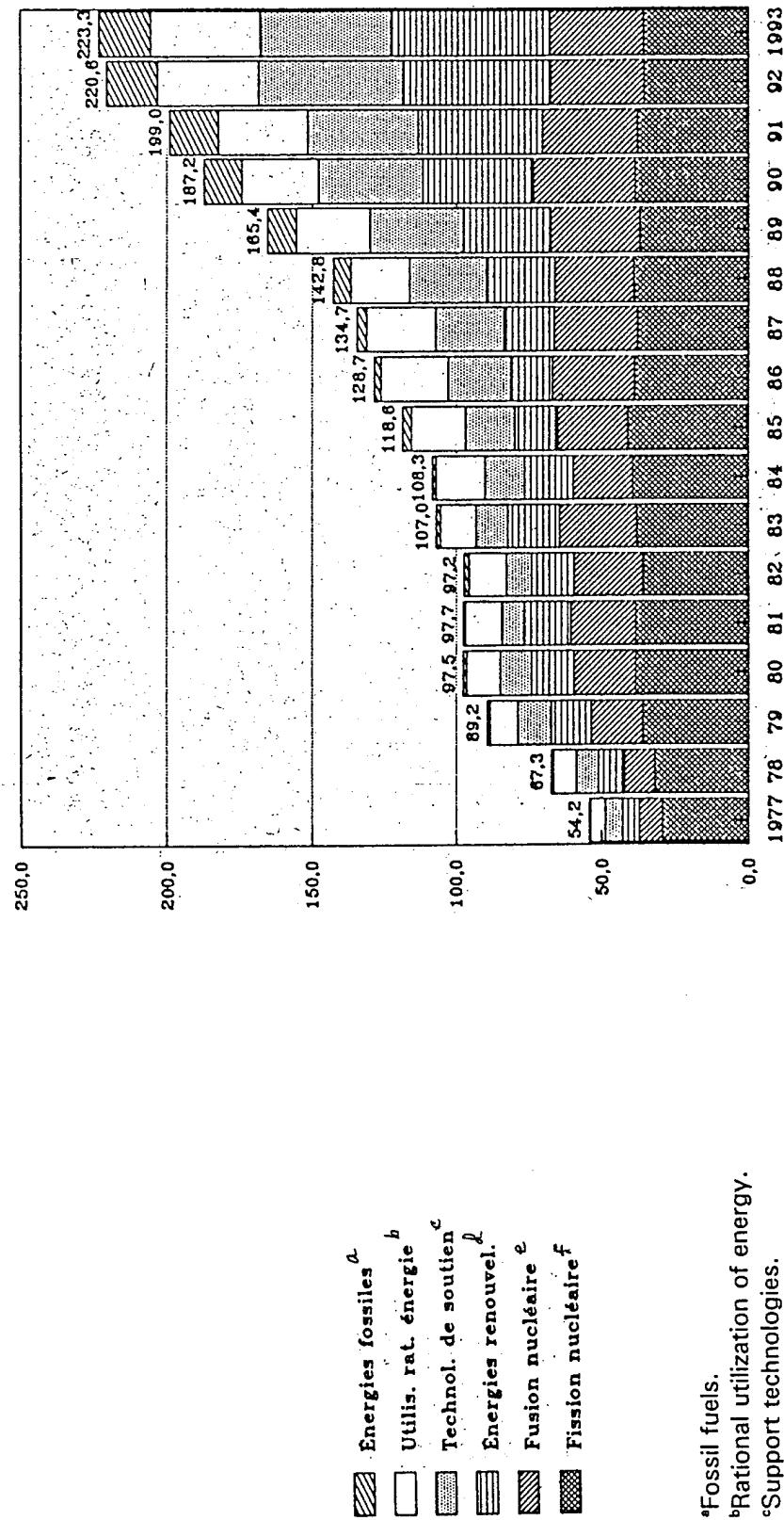
Source: Based on information from Switzerland, L'Office fédéral de l'énergie, Recherche, développement et démonstration dans le domaine de l'énergie en Suisse: Liste des projets, 1992/1993, Berne, April 1994, 2.

TABLE 61. SWITZERLAND: ENERGY R&D EXPENDITURES ACCORDING TO THE SWISS CLASSIFICATION SYSTEM, 1990-1993
 (In millions of Swiss francs)

Area of Research	1990	1991	1992	1993
I. Rational utilization of energy	26.4 (14.1%)	20.7 (15.4%)	34.6 (15.7%)	37.4 (16.7%)
II. Fossil fuels	13.0 (6.9%)	16.7 (8.4%)	17.5 (7.9%)	17.8 (8.0%)
III. Nuclear fission	38.6 (20.6%)	37.8 (19.0%)	35.4 (16.0%)	35.7 (16.0%)
IV. Renewable sources of energy	38.0 (20.3%)	43.0 (21.6%)	51.3 (23.3%)	55.1 (24.7%)
V. Nuclear fusion	25.0 (18.7%)	32.5 (16.3%)	32.0 (14.5%)	32.2 (14.4%)
VI. Support technologies	36.2 (19.4%)	38.3 (19.3%)	49.8 (22.6%)	45.1 (20.2%)
TOTAL	187.2 (100.0%)	199.0 (100.0%)	220.6 (100.0%)	223.3 (100.0%)

Source: Based on information from Switzerland, L'Office fédéral de l'énergie, Recherche, développement et démonstration dans le domaine de l'énergie en Suisse: Liste des projets, 1992/1993, Berne, April 1994, 4.

FIGURE 1. SWITZERLAND: EXPENDITURES FOR ENERGY R&D, 1977-93
(In millions of Swiss francs)



^aFossil fuels.

^bRational utilization of energy.

^cSupport technologies.

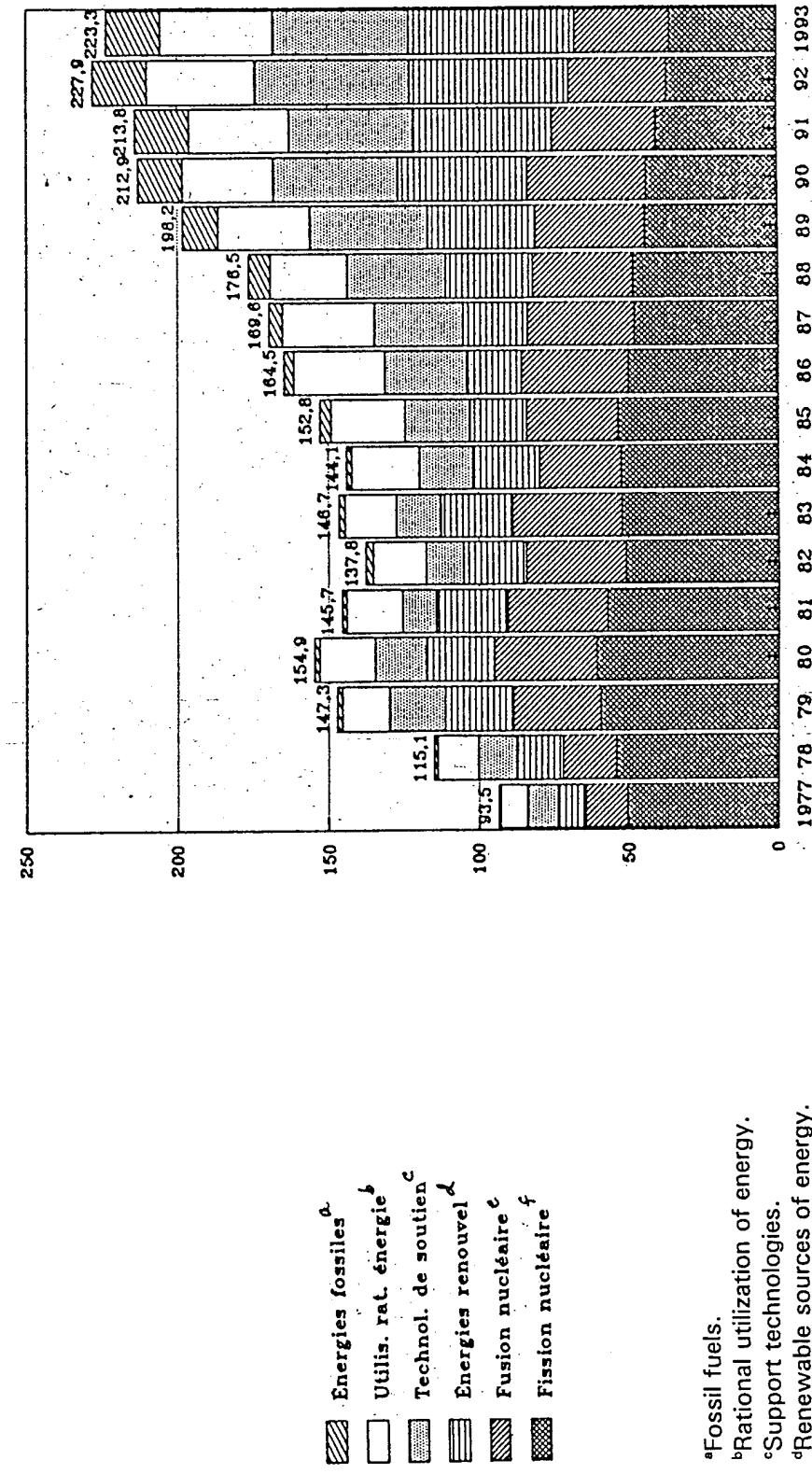
^dRenewable sources of energy.

^eNuclear fusion.

^fNuclear fission.

Source: Based on information from Switzerland, L'Office fédéral de l'énergie, Recherche, développement et démonstration dans le domaine de l'énergie en Suisse: Liste des projets, 1992/1993, Berne, April 1994, 6.

FIGURE 2. SWITZERLAND: EXPENDITURES FOR ENERGY R&D, CORRECTED FOR INFLATION (1993 = 100%),
1977-93
(In millions of Swiss francs)



^aFossil fuels.

^bRational utilization of energy.

^cSupport technologies.

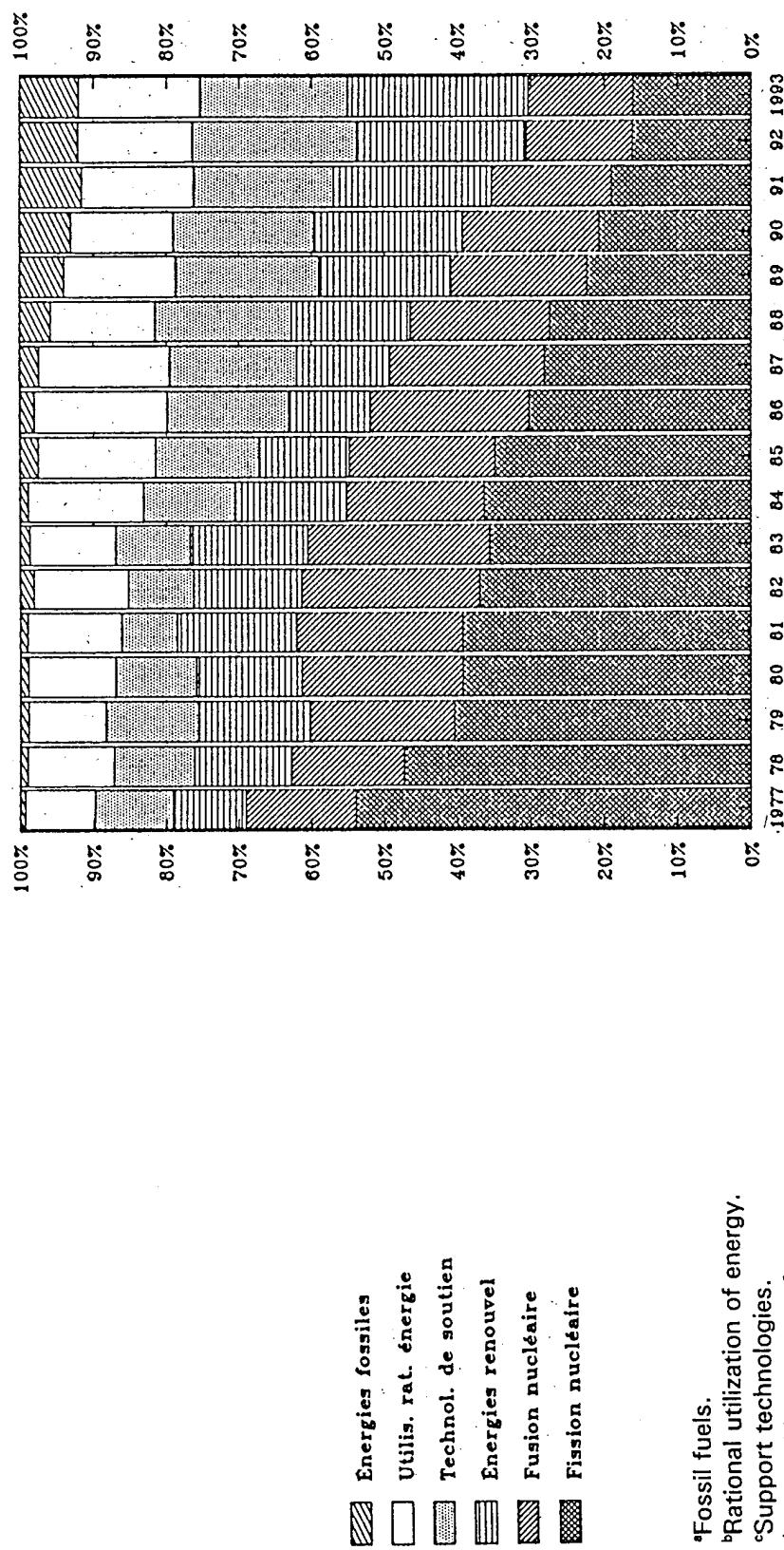
^dRenewable sources of energy.

^eNuclear fusion.

^fNuclear fission.

Source: Based on information from Switzerland, L'Office fédéral de l'énergie, Recherche, développement et démonstration dans le domaine de l'énergie en Suisse: Liste des projets, 1992/1993, Berne, April 1994, 6.

FIGURE 3. SWITZERLAND: PROPORTIONAL DISTRIBUTION OF ENERGY R&D EXPENDITURES, 1977-93
(In percentages)



^aFossil fuels.

^bRational utilization of energy.

^cSupport technologies.

^dRenewable sources of energy.

^eNuclear fusion.

^fNuclear fission.

Source: Based on information from Switzerland, L'Office fédéral de l'énergie, Recherche, développement et démonstration dans le domaine de l'énergie en Suisse: Liste des projets, 1992/1993, Berne, April 1994, 7.

TABLE 62. SWITZERLAND: DISTRIBUTION OF ENERGY R&D FUNDING BY PUBLIC ORGANIZATIONS, BY SOURCE OF FINANCING, 1991
(In millions of Swiss francs)

Area of Research	Total	Federal Offices				Cantons and Communes		NEFF ^e
		CEPF ^a	FN ^b	CERS ^c	OFEN ^d	Various		
I. Rational utilization of energy	30.7	8.9	0.5	1.5	9.9	0.9	3.6	5.4
II. Fossil fuels	16.7	10.8	0	0.5	3.4	0	0.1	1.9
III. Nuclear Fission	37.8	30.2	0.3	0	4.0	3.0	0.3	0
IV. Renewable sources of energy	43.0	10.1	0.7	0.2	17.0	0.9	11.9	2.2
V. Fusion	32.5	17.1	1.6	0.1	0.2	11.7 ^f	0.8	1.0
VI. Support technologies	38.3	19.8	0.8	2.1	7.2	0.8	3.9	3.7
TOTAL	199.0	96.9	3.9	4.4	41.7	17.3	20.6	14.2

^aConseil des Écoles polytechniques fédérales (Board of Swiss Federal Institutes of Technology), a public organization.

^bFonds national suisse de la recherche scientifique (Swiss National Science Foundation), a private organization.

^cCommission pour l'encouragement de la recherche scientifique (Committee for the Promotion of Scientific Research), a public organization.

^dOffice fédéral de l'énergie (Federal Energy Office), a public organization.

^eFonds national pour la recherche énergétique (National Foundation for Energy Research).

^fWith federal contributions from OFES (Office fédéral de l'éducation et de la science/Federal Office of Education and Science) to EURATOM and JET.

Source: Based on information from Switzerland, L'Office fédéral de l'énergie, Recherche, développement et démonstration dans le domaine de l'énergie en Suisse: Liste des projets, 1992/1993, Berne, April 1994, 9.

TABLE 63. SWITZERLAND: DISTRIBUTION OF ENERGY R&D FUNDING BY PUBLIC ORGANIZATIONS, BY SOURCE OF FINANCING, 1992
(In millions of Swiss francs)

Conseil des Écoles polytechniques fédérales (Board of Swiss Federal Institutes of Technology), a public organization.

¹⁰Fonds national suisse de la recherche scientifique (Swiss National Science Foundation), a private organization.

^aCommission pour l'encouragement de la recherche scientifique (Committee for the Promotion of Scientific Research), a public organization

Office fédéral de l'énergie (Energie, Office) a publié une organisation

Office fédéral de l'énergie (Federal Energy Office), a public organization.

**With federal contributions from OFES (Office fédéral de l'éducation et de la science/Federal Office of Education and Science) to
ELBATOM and JET.**

Source: Based on information from Switzerland, L'Office fédéral de l'énergie, Recherche, développement et démonstration dans le domaine de l'énergie en Suisse: Liste des projets, 1992/1993, Berne, April 1994, 9.

TABLE 64. SWITZERLAND: DISTRIBUTION OF ENERGY R&D FUNDING BY PUBLIC ORGANIZATIONS, BY SOURCE OF FINANCING, 1993
(In millions of Swiss francs)

Area of Research	Total	Federal Offices				Cantons and Communes		NEFF*
		CEPF*	FN ^b	CERS ^c	OFEN ^d	Various		
I. Rational utilization of energy	37.4	12.2	0.3	1.6	11.0	0.7	5.2	6.4
II. Fossil fuels	17.9	11.1	0.1	0.3	1.9	0.2	0	4.3
III. Nuclear Fission	35.7	25.8	0.3	0	5.2	3.7	0.1	0.6
IV. Renewable sources of energy	55.0	14.1	0.6	1.3	20.9	2.3	13.6	2.2
V. Fusion	32.2	17.2	1.7	0	0.2	12.2 ^e	0.9	0
VI. Support technologies	45.1	24.8	0.5	1.0	7.2	1.8	4.8	5.0
TOTAL	105.2	3.5	4.2	46.4	20.9		24.6	18.5

*Conseil des Écoles polytechniques fédérales (Board of Swiss Federal Institutes of Technology), a public organization.

^bFonds national suisse de la recherche scientifique (Swiss National Science Foundation), a private organization.

^cCommission pour l'encouragement de la recherche scientifique (Committee for the Promotion of Scientific Research), a public organization.

^dOffice fédéral de l'énergie (Federal Energy Office), a public organization.

^eFonds national pour la recherche énergétique (National Foundation for Energy Research).

^fWith federal contributions from OFES (Office fédéral de l'éducation et de la science/Federal Office of Education and Science) to EURATOM and JET.

Source: Based on information from Switzerland, L'Office fédéral de l'énergie, Recherche, développement et démonstration dans le domaine de l'énergie en Suisse: Liste des projets, 1992/1993, Berne, April 1994, 9.

TABLE 65. SWITZERLAND: DISTRIBUTION OF FUNDS AMONG ENERGY RESEARCH INSTITUTIONS, 1992
 (In millions of Swiss francs)

Research Institution	Total	From CEFPI*	From FN ^b	From CERS ^c	From OPEN ^d	Other Federal Departments*	Cantons and Communes	From NEFF ^e
Federal Institute of Technology of Zurich ^g	29.5	19.2	0.3	1.5	2.2	0.8	0.2	5.3
Federal Institute of Technology of Lausanne ^h	52.8	34.4	2.0	1.6	3.4	9.0	0.3	2.1
Federal Materials Testing Laboratory and Research Institute ⁱ	3.0	1.6	0	0	0.8	0	0	0.6
Paul Scherrer Institute ^j	60.7	50.4	0.2	0.1	4.6	4.3	0	1.1
Other federal departments	3.6	0.1	0	0	1.7	1.7	0.1	0
Universities	15.7	0	1.4	0	4.0	0	10.1	0.2
ETS/Engineering Schools ^k	5.5	0	0	0.8	1.6	0	2.8	0.3
Other canton departments	0.3	0	0	0	0	0	0.3	0
Private sector	49.5	0.2	0.6	0.6	26.9	4.3	8.7	8.2

*Conseil des Écoles polytechniques fédérales (Board of Swiss Federal Institutes of Technology), a public organization.

^bFonds national suisse de la recherche scientifique (Swiss National Science Foundation), a private organization.

^cCommission pour l'encouragement de la recherche scientifique (Committee for the Promotion of Scientific Research), a public organization.
^dOffice fédéral de l'énergie (Federal Energy Office), a public organization.

^e"Service".

^gÉcole polytechnique fédérale de Zurich.
^hÉcole polytechnique fédérale de Lausanne.

ⁱLaboratoire fédéral d'essai des matériaux et de recherches, Dübendorf.
^jInstitut Paul Scherrer, Villigen.

^kÉcole technique supérieure/Écoles d'ingénieurs (Technical College/Engineering Schools).

Source: Based on information from Switzerland, L'Office fédéral de l'énergie, Recherche, développement et démonstration dans le domaine de l'énergie en Suisse: Liste des projets, 1992/1993, Berne, April 1994, 10.

TABLE 66. SWITZERLAND: DISTRIBUTION OF FUNDS AMONG ENERGY RESEARCH INSTITUTIONS, 1993
(In millions of Swiss francs)

Research Institution	Total	From CEPF*	From FN ^b	From CERS ^c	From OPEN ^d	Other Federal Departments*	Cantons and Communes	From NEFF ^e
Federal Institute of Technology of Zurich ^g	31.4	21.4	0.2	1.2	2.7	0.9	0.2	4.8
Federal Institute of Technology of Lausanne ^h	53.2	32.7	1.9	1.2	2.9	11.7	0.4	2.4
Federal Materials Testing Laboratory and Research Institute ⁱ	4.6	2.6	0	0	1.3	0.2	0	0.5
Paul Scherrer Institute ^j	62.0	48.2	0.2	0.2	8.3	4.3	0	0.8
Other federal departments	3.1	0.1	0	0	1.0	2.0	0	0
Universities	13.1	0	0.8	0.2	2.8	0	9.1	0.2
ETS/Engineering Schools ^k	5.8	0	0	0.6	1.9	0	3.1	0.2
Other canton departments	0.7	0	0	0	0.1	0.3	0.3	0
Private sector	49.4	0.2	0.4	0.8	25.4	1.5	11.5	9.6

*Conseil des Écoles polytechniques fédérales (Board of Swiss Federal Institutes of Technology), a public organization.

^bFonds national suisse de la recherche scientifique (Swiss National Science Foundation), a private organization.

^cCommission pour l'encouragement de la recherche scientifique (Committee for the Promotion of Scientific Research), a public organization.

^dOffice fédéral de l'énergie (Federal Energy Office), a public organization.

^eService .

^fFonds national pour la recherche énergétique (National Foundation for Energy Research).

^gÉcole polytechnique fédérale de Zurich.

^hÉcole polytechnique fédérale de Lausanne.

ⁱLaboratoire fédéral d'essai des matériaux et de recherches, Dübendorf.

^jInstitut Paul Scherrer, Villigen.

^kÉcole technique supérieure/Écoles d'ingénieurs (Technical College/Engineering Schools).

Source: Based on information from Switzerland, L'Office fédéral de l'énergie, Recherche, développement et démonstration dans le domaine de l'énergie en Suisse: Liste des projets, 1992/1993, Berne, April 1994, 10.

TABLE 67. SWITZERLAND: DISTRIBUTION OF PUBLIC FUNDS AMONG ENERGY RESEARCH INSTITUTIONS, BY AREA OF RESEARCH, 1991
(In thousands of Swiss francs)

Area of Research	Federal Institutes of Technology (EPF)				Other Federal Departments	Universities	Engineering Schools (ETS)*	Other Canton Departments	Private Sector
	EPF-Z ^a	EPF-L ^b	EMPA ^c	PSI ^d					
I. Rational utilization of energy	5,551	4,440	2,290	1,743		155	569	1,995	
II. Fossil fuels	8,146	0	310	6,040		120	0	0	0
III. Nuclear fission	1,360	930	0	33,509		220	618	0	6
IV. Renewable sources of energy	3,868	4,325	200	5,521		1,323	6,978	3,244	159
V. Nuclear fusion	0	22,529	0	8,790		10	1,206	0	0
VI. Support technologies	5,471	7,794	0	12,996		120	3,923	417	0
	24,396	40,018	2,800	68,599		1,948	13,294	5,656	420
TOTAL						137,761		19,370	41,858

*École polytechnique fédérale de Zurich.

^bÉcole polytechnique fédérale de Lausanne.

^cLaboratoire fédéral d'essai des matériaux et de recherches, Dübendorf.

^dInstitut Paul Scherrer, Villigen.

*École technique supérieure/Écoles d'ingénieurs (Technical College/Engineering Schools).

Source: Based on information from Switzerland, L'Office fédéral de l'énergie, Recherche, développement et démonstration dans le domaine de l'énergie en Suisse: Liste des projets, 1992/1993, Berne, April 1994, 13.

TABLE 68. SWITZERLAND: DISTRIBUTION OF PUBLIC FUNDS AMONG ENERGY RESEARCH INSTITUTIONS, BY AREA OF RESEARCH, 1992
(In thousands of Swiss francs)^a

Area of Research	Federal Institutes of Technology (EPF)				Other Federal Departments	Universities	Engineering Schools (ETS) ^b	Other Canton Departments	Private Sector
	EPF-Z ^c	EPF-L ^b	EMPA ^c	PSI ^d					
I. Rational utilization of energy	6,494	8,610	2,074	1,150	0	0	2,530	250	13,460
II. Fossil fuels	7,144	550	0	5,414	50	0	0	0	4,257
III. Nuclear fission	2,908	1,506	0	30,141	120	30	0	0	773
IV. Renewable sources of energy	4,794	9,109	629	4,324	2,881	7,642	2,073	83	19,791
V. Nuclear fusion	0	25,375	0	4,505	20	2,077	0	0	0
VI. Support technologies	8,285	7,500	240	15,,171	620	5,882	900	0	11,182
	29,625	52,650	2,943	60,705	3,691	15,631	5,503	333	
TOTAL					149,614		21,467	49,463	

^aÉcole polytechnique fédérale de Zurich.

^bÉcole polytechnique fédérale de Lausanne.

^cLaboratoire fédéral d'essai des matériaux et de recherches, Dübendorf.

^dInstitut Paul Scherrer, Villigen.

^eÉcole technique supérieure/Écoles d'ingénieurs (Technical College/Engineering Schools).

Source: Based on information from Switzerland, L'Office fédéral de l'énergie, Recherche, développement et démonstration dans le domaine de l'énergie en Suisse: Liste des projets, 1992/1993, Berne, April 1994, 13.

TABLE 69. SWITZERLAND: DISTRIBUTION OF PUBLIC FUNDS AMONG ENERGY RESEARCH INSTITUTIONS, BY AREA OF RESEARCH, 1993
(In thousands of Swiss francs)

Area of Research	Federal Institutes of Technology (EPF)				Other Federal Departments	Universities	Engineering Schools (ETS)*	Other Canton Departments	Private Sector
	EPF-Z*	EPF-L ^b	EMPA ^c	PSI ^d					
I. Rational utilization of energy	5,352	7,885	3,151	830	0	0	2,364	634	17,219
II. Fossil fuels	9,081	550	0	5,314	50	0	0	0	2,831
III. Nuclear fission	2,679	1,207	0	29,715	270	90	0	0	1,729
IV. Renewable sources of energy	4,041	8,887	1,192	8,278	2,143	7,729	2,423	61	20,287
V. Nuclear fusion	0	27,240	0	3,765	20	1,203	0	0	0
VI. Support technologies	10,244	7,388	261	14,089	620	4,082	1,040	0	7,386
	31,397	53,157	4,604	61,991	3,103	13,104	5,827	695	
TOTAL					154,252		19,626	49,452	

*École polytechnique fédérale de Zurich.

^bÉcole polytechnique fédérale de Lausanne.

^cLaboratoire fédéral d'essai des matériaux et de recherches, Dübendorf.

^dInstitut Paul Scherrer, Villigen.

*École technique supérieure/Écoles d'ingénieurs (Technical College/Engineering Schools).

Source: Based on information from Switzerland, L'Office fédéral de l'énergie, Recherche, développement et démonstration dans le domaine de l'énergie en Suisse: Liste des projets, 1992/1993, Berne, April 1994, 13.

**TABLE 70. SWITZERLAND: TOTAL EXPENDITURES FOR ENERGY RESEARCH, BY SECTOR,^a 1993
(In millions of Swiss francs)^a**

Area of Research	Public Sector ^b	Private Sector ^c
I. Rational utilization of energy	31.0 (8.7)	125 (199)
II. Fossil fuels	13.5 (0.5)	150 (125)
III. Nuclear fission	35.1 (0)	5 (0)
IV. Renewable sources of energy	52.9 (18.2)	35 (25)
V. Nuclear fusion	32.2 (0)	0 (0)
VI. Support technologies	40.1 (2.4)	585 (500)
TOTAL	204.8 (29.8)	900 (750)

^aThe figures in parentheses refer to funds for development, pilot, or demonstration projects.

^bExcluding NEFF (Fonds national pour la recherche énergétique/National Foundation for Energy Research).

^cIncluding NEFF.

Source: Based on information from Switzerland, L'Office fédéral de l'énergie, Recherche, développement et démonstration dans le domaine de l'énergie en Suisse: Liste des projets, 1992/1993, Berne, April 1994, 21.

TABLE 71. SWITZERLAND: FEDERAL PROGRAMS FOR ENERGY RESEARCH AND EXPENDITURES, 1992 AND 1993
(In millions of Swiss francs)

AREA OF RESEARCH	RESEARCH PROGRAMS	1992	1993
I.	1. Rational use of energy in buildings	11.5	12.7
	2. Rational use of energy in transportation	9.9	10.7
	3. Recovery of ambient heat and waste heat	9.6	10.0
	4. Heating and combustion	20.2	20.7
III.	5. Security and new reactor systems	35.5*	35.7*
	6. Regulatory research		
IV.	7. Solar architecture	4.5	5.3
	8. Active solar energy and heat storage	5.5	6.4
	9. Photovoltaics	18.6	15.2
	10. Thermochemical energy	4.2	5.7
	11. Photochemistry	3.4	4.3
	12. Wind energy	0.1	0.2
	13. Biomass	8.2	9.3
	14. Geothermal energy	5.0	7.3
	15. Nuclear fusion	32.0	32.2
	16. Electricity	19.4	17.6
VI.	17. Hydrogen	7.2	6.1
	18. Electrochemistry	6.4	5.7
	19. Fuel cells	5.3	4.0
	20. Socio-economic programs	12.3	12.5
	TOTAL	220.6	223.3

See next page for footnotes.

Table 71. Continued

"Work on the program "Regulatory Research" is an integral part of the program "Security and New Reactor Systems". It is therefore not possible to give a precise figure for it. Funds authorized for "Regulatory Research" is estimated to be approximately 8 million Swiss Francs per year.

Source: Based on information from Switzerland, L'Office fédéral de l'énergie, Recherche, développement et démonstration dans le domaine de l'énergie en Suisse: Liste des projets, 1992/1993, Berne, April 1994, 22.

TABLE 72. SWITZERLAND: PARTIAL LIST OF ENERGY RESEARCH PROJECTS, 1993

Project Title	Responsible Institutions*	Sources of Financing ^b	Project Size, 1993 ^c	Type of Project ^d
VALORIZATION OF AMBIENT HEAT, THERMAL WASTES, AND FORCED-AIR SYSTEMS				
Optimization of heat production and distribution in a heating network	EPFZ	OPEN, C-EPF	*	P+D
Evaluation of alternative heat-production plants	Private	OPEN	T	P+D
PHOTOVOLTAIC ENERGY				
Bipolar transport in amorphous silicon	Uni NE	FN, Ct NE	T	-
Thin solar cells of crystalline silicon	PSI	OPEN, C-EPF	****	B
Development of low-temperature processing steps for a silicon technology in an ultra-high vacuum	EPFZ	C-EPF, CERS	***	B
Study of parameters for cutting silicon by grinding	Private	OPEN	*	-
EUROCAD (Cadmium-telluride thin solar cells)	EPFZ	C-EPF, NEFF	*	Int
Large-scale partitioning of amorphous silicon	EPFL	OPEN, C-EPF	**	B
Heteroepitaxy of silicon	EPFZ	C-EPF, FN	**	B
Behavior of VHF plasma	Uni NE	OPEN, Ct NE	****	B
Physical plasma properties of RF plasmas	EPFL	OPEN, C-EPF	****	B
Amorphous silicon solar cells	Uni NE	OPEN, Ct NE	****	B
Production of silicon layers for solar cells	EPFZ	NEFF	****	B
ELECTRICITY				
Computation processes for designing of flutter-free low-pressure turbine blades	EPFL	C-EPF, NEFF	T	-
Economic and reliable turbine blading	Private	CERS	**	Int
Evaluation of Francis turbine performance	EPFL	CERS, C-EPF	T	-
Gas turbine vanes and blades, COST 501/II; Advanced blading	Private	OPEN, Conf.	T	Int

Project Title	Responsible Institutions ^a	Sources of Financing ^b	Project Size, 1993 ^c	Type of Project ^d
High-efficiency network electricity directors in hybrid structures	EPFZ	OPEN, C-EPF	* *	-
Gasket strengths in hydro and thermal turbines	EPFZ	C-EPF	T	-
Turbines and valve casings (COST501)	Private	Conf.	T	Int
Frequency-conversion technology for renewable sources of energy	ETS	OPEN, Ct VS	***	-
Examination of heat transition on gas turbine blades	EPFL	CERS, C-EPF	T	-
VSI for generators with AC three-phase excitation	EPFZ	C-EPF	* *	-
On-line condition-monitoring system for steam-turbine groups with integrated expert systems	Private	NEFF	*	-
ELECTROCHEMICAL ENERGY--FUEL CELLS				
Bipolar batteries	Private	Ct GE	*	P + D
Electrolytic CO ₂ reduction	EPFZ	OPEN, C-EPF	T	B
Fixing molecular nitrogen by electrochemical reduction	Uni GE	OPEN, Ct GE	T	B
Designing an electrochemical reactor	EPFL	OPEN, C-EPF	T	B
Current loss and distribution in an electrochemical reactor	EPFL	C-EPF	* *	B

^aEPFL = Federal Institute of Technology of Lausanne (École polytechnique fédérale de Lausanne).
^bEPFZ = Federal Institute of Technology of Zurich (École polytechnique fédérale de Zurich).

ETS = Technical College (Ecole technique supérieure).

PSI = Paul Scherrer Institute (Institut Paul Scherrer).

Uni GE = University of Geneva.

Uni NE = University of Neuchâtel.

^cC-EPF = Board of Swiss Federal Institutes of Technology (Conseil des Écoles polytechniques fédérales).

CERS = Committee for the Promotion of Scientific Research (Commission pour l'encouragement de la recherche scientifique).

Conf. = Research institutes under the Confederation or Federal Offices (Instituts de recherche de la Confédération ou Offices fédéraux).

Ct GE = Department of canton Genève.

Ct NE = Department of canton Neuchâtel.

Ct VS = Department of canton Valais.

FN = Swiss National Science Foundation (Fonds national suisse de la recherche scientifique).

NEFF = National Foundation for Energy Research (Fonds national pour la recherche énergétique).

OPEN = Federal Office of Energy (Office fédéral de l'énergie).

Table 72. Continued

^aT = Project ended in 1990

* = Cost of the project less than 70,000 Swiss Francs.

** = Cost of the project between 70,000 and 300,000 Swiss Francs.

*** = Cost of the project between 300,000 and 1 million Swiss Francs.

**** = Cost of the project more than 1 million Swiss Francs.

^bB = Basic research project.

Int = International collaboration project.

P + D = Pilot, demonstration, or research projects at these installations.

Source: Based on information from Switzerland, L'Office fédéral de l'énergie, Recherche, développement et démonstration dans le domaine de l'énergie en Suisse: Liste des projets, 1992/1993, Berne, April 1994, various pages.

TAIWAN

TABLE 73. TAIWAN: ENERGY R&D BUDGET, FY1989-93^a
(In thousands of U.S. dollars)

Energy Source	FY1989	FY1990	FY1991	FY1992	FY1993
Oil and gas	50,000 ^b	50,000 ^b	50,000 ^b	50,000 ^b	52,000
Solar					
Solar heating and cooling	810	740	930	1,300	920
Solar photo electric	540	550	270	420	580
Solar thermal electric	0	110	0	50	0
TOTAL SOLAR	1,350	1,400	1,200	1,770	1,500
Other new sources					
Wind	550	330	190	80	220
Ocean	310	160	280	460	650
Biomass	500	180	480	500	630
Geothermal	180	160	300	460	460
TOTAL SOLAR AND OTHER NEW SOURCES	2,890	2,230	2,420	3,270	3,460
Miscellaneous--I (Electric Power)	30,000 ^b	30,000 ^b	30,000 ^b	32,000	34,000
Miscellaneous--II (Energy Conservation)	15,710	19,970	27,380	27,730	26,840
TOTAL ENERGY R&D BUDGET	98,600	102,200	109,800	113,000	116,300

^aTaiwan's fiscal year begins July 1.

^bEstimated.

Source: Based on information from Taiwan, Ministry of Economic Affairs, Energy Commission. (Fax transmission from Shouchung Li.)

UNITED KINGDOM

TABLE 74. UNITED KINGDOM: DEPARTMENT OF TRADE AND INDUSTRY ENERGY R&D BUDGET, FY1990-94^a
(In millions of pounds sterling)

Energy Source	Primary Purpose	Outturn			Estimat e	Provisio n			
		1990- 91	1991- 92	1992- 93					
Non-nuclear									
Offshore oil and gas									
Industrial/technology support	Technology Support ^b	3.7	3.5	2.4	2.9	2.9			
Enhanced oil recovery	Policy Support ^c	1.7	0.4	0.5	0.5	0.5			
	General Support for Research ^d	0.1	-	-	-	-			
Safety ^e	Policy Support	7.0	-	-	-	-			
Energy efficiency ^f	Technology Support	2.3	2.6	-	-	-			
Renewables	Technology Support	20.0	22.9	23.0	21.1	16.3			
Coal technology	Technology Support	11.8	4.7	4.0	7.0	7.0			
TOTAL NON-NUCLEAR	-	46.6	34.1	29.7	31.4	26.7			
Nuclear									
TOTAL NUCLEAR	-	106.5	92.2	82.7	53.9	25.5			
TOTAL FORMER DEPT. OF ENERGY NET EXPENDITURES	-	153.1	126.3	-	-	-			
TOTAL DEPT. OF TRADE AND INDUSTRY EXPENDITURES	-	-	-	350.8	310.3	245.0			

See next page for footnotes.

- The United Kingdom's fiscal year begins April 1.
- Applied R&D which the government funds to advance the technology of the U.K. economy. Includes strategic as well as applied research, and includes precompetitive research.
- Covers all research which the government funds to form policy (excluding general support for research and government services) and to monitor developments significant for the welfare of the population.
- Includes all basic and applied R&D which advances knowledge and which cannot be classified in the other primary purposes. Includes support for post-graduate research.
- Transferred to the Health and Safety Commission as of April 1991.
- The Energy Efficiency Office transferred to the Department of the Environment as of April 1992.

Source: Based on information from the United Kingdom, Office of Public Service and Science, Office of Science and Technology, Annual Review of Government Funded Research and Development 1993, London, 1993, 259, and the United Kingdom, Office of Public Service and Science, Office of Science and Technology, Forward Look of Government-Funded Science, Engineering, and Technology 1994, (Statistical supplement.), London, 1994, 132.

TABLE 75. UNITED KINGDOM: DEPARTMENT OF TRADE AND INDUSTRY
 EXPENDITURES ON RENEWABLE ENERGY FY1989-92*
 (In millions of pounds sterling)

Fiscal	Expenditures	Expenditures in 1992-93 Prices
1989-90	17.9	21.2
1990-91	20.8	22.7
1991-92	24.8	25.7
1992-93	25.6	25.6

Source: Based on information from the United Kingdom, National Audit Office, The Renewable Energy Research, Development, and Demonstration Programme, London, 1994, 7.

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